Section 5 – Traffic Management Activities

Traffic Flow Management (TFM) is the strategic planning and management of air traffic demand to ensure smooth and efficient traffic flow through FAA-controlled airspace. To support this mission, traffic management specialists (TMSs) at the ATCSCC and traffic management coordinators (TMCs) at local facilities (ARTCCs, TRACONs, and towers) use a combination of automation systems and procedures.

TMSs at the ATCSCC monitor traffic, weather, resource capacity, and equipment status across the NAS to develop a system-wide perspective of NAS traffic flows and the implications of local situations (i.e. situations that affect the operations of a single en route center or a single approach control facility). TMSs are trained to work toward system-wide efficiency without allegiance to an individual en route center, approach control facility, or tower.

ARTCC and TRACON facility TMCs generally manage traffic situations affecting their airspace. They coordinate with neighboring facilities through the ATCSCC as needed and report status information to the ATCSCC. When traffic situations have broad impacts or when the underlying cause is extreme or long lasting, however, the ATCSCC takes the lead in planning and coordination.

Traffic Management Initiatives

Traffic management personnel employ the least restrictive methods available to minimize delays. Dynamic initiatives are those imposed on an as-needed basis to manage fluctuations in traffic demands. The list of these initiatives is not exhaustive and does not preclude ‘innovation’. The objective is safety, efficiency and improved customer service.

In order from least restrictive to most restrictive methods, these include:

- Altitude
- Miles-In-Trail / Minutes-In-Trail
- Speed Control
- Airborne Holding
- Sequencing Programs (Departure Spacing Program (DSP), Enroute Sequencing Program (ESP), Arrival Sequencing Program (ASP)
- Rerouting
- Ground Delay Programs
- Ground Stop.

Traffic Management Procedures

FAA Order (FAO) 7110.65 mandates the following general procedure in determining the need for and implementing any traffic management initiative.

TM specialists conduct initial assessments of demand versus capacity by gathering and evaluating all data available to make an informed decision. This information includes traffic counts and lists from ETMS and FSM, and may be supplemented by coordination with any involved facilities.

Internal options are considered prior to requesting interfacility initiatives. When an interfacility initiative is considered necessary, the local facility coordinates this through the ATCSCC by providing the ATCSCC area specialist with a detailed, specific problem description, a synopsis of actions considered and already taken, or considered and not implemented, a summary of other options available, and an analysis of what the preferred interfacility action may entail (who is involved and what impacts might there be, implemented or not).

The ATCSCC specialist then advises the requesting facility of other impacts they may not be aware of, and coordinates a discussion about the proposed initiative between the involved facilities. If the proposal is for a GDP, large scale reroutes, or arrival/departure delays, the ATCSCC also brings the users into the discussion if possible. The ATCSCC then issues the appropriate restriction (in the form of an advisory).

Once the restriction or program is in place, local facilities are required to monitor its implementation and evaluate, record, and report on the actual impacts. If further action is required, the local facility again coordinates any such changes. All involved parties are required to keep accurate, comprehensive, and complete documentation, including feedback from the ATCSCC and affected facilities, since this information is critical to improvement in the future, and can form the basis for determining whether restrictions may be 'historically validated'.

Section Organization

This section breaks down traffic flow management into three groups of activities/processes: TM Situation Awareness, TM Initiative Planning and Implementation, and Operational Planning and Analysis, as depicted below in Exhibit 5-1. National/Site Traffic Management Activities. Discussions of the activities/processes provided in the following subsections include tools, users, data, and interfaces involved in the performance of traffic flow management. The focus of this document is on TFM-I domain systems, but other systems involved in supplying data or otherwise used within the operational arena in the performance of TFM functions are also mentioned in this section. Further information about the tools is discussed available in Section 6, TFM Tools and Products.

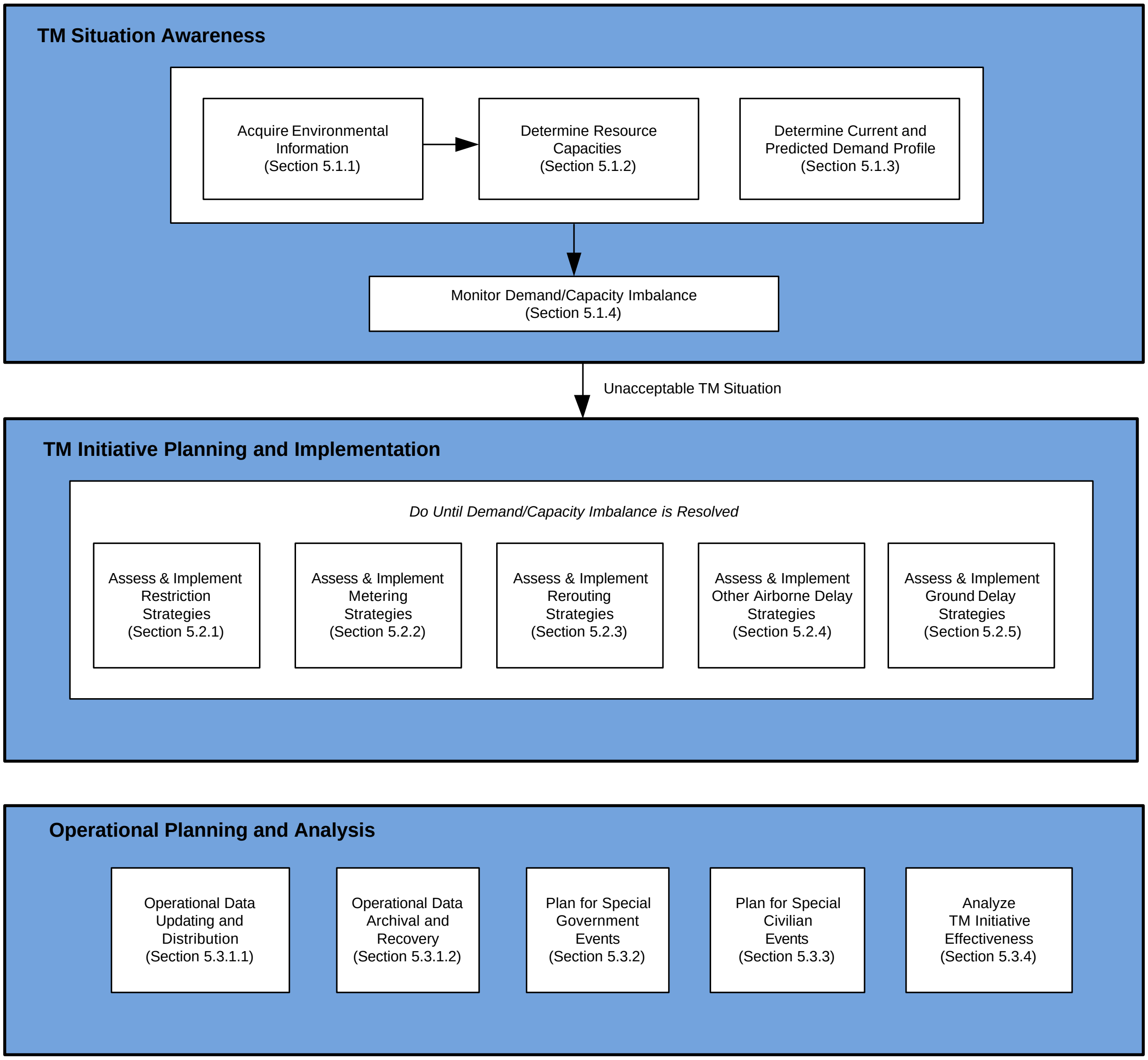

Exhibit 5-1. National/Site Traffic Management Activities

5.1 TM Situation Awareness

This section describes techniques and tools used by TM personnel to acquire and maintain situational awareness about current and near-future operational conditions.

Constant and common situational awareness is critical to the early detection and efficient resolution of traffic flow problems across the NAS. Today users are becoming more and more involved in this process through the CDM initiatives for sharing real-time information between the FAA and airlines. Much the same general kinds of information is required by FAA specialists and airline operators alike – weather, traffic, and knowledge about other factors that can affect the capacity of the system to handle the demands being placed on it, particularly during severe weather events. Often today, the same data is seen by all concerned parties and forms the basis for coordinated demand prediction, capacity assessment, initiative determination and implementation, and impact mitigation.

TM specialists first apprise themselves of the current environmental situation and determine if there is, or could be, a problem (i.e. an imbalance between capacity and demand). Then the specialists determine to what extent any evolving or predicted problem may impact operations and confer with all affected parties before deciding what the best solution might be. This process is repeated throughout the day as necessary to maintain awareness and deal with congestion or weather related traffic flow situations.

This section covers collection of background information as well as the problem and impact determination process that supports and precedes further analysis, planning and implementation of TM initiatives. The steps in this part of the overall traffic flow management process have been broken down in the following subsections:

- Section 5.1.1, Acquire Environmental Information
- Section 5.1.2, Determine Resource Capacities
- Section 5.1.3, Determine Current and Predicted Demand Profile
- Section 5.1.4, Monitor for Demand / Capacity Imbalance.

5.1.1 Acquire Environmental Information

This subsection describes the processes, tools, and data used at both national and local traffic management facilities to acquire a 'big picture' of the environment. Discussions here include the type of information that is critical to TFM operations, how the information is gathered, and the tools used for this process.

Acquiring the current and projected status of the NAS environment is a prerequisite to determining capacity of the NAS. Information critical to the determination of NAS capacity includes:

- Weather - current and forecasted weather, icing, deicing status, winds, visibility, etc.
- NAS Status Information – NAVAID and equipment outages, runway configurations, airport/runway conditions, procedures in effect (i.e. noise abatement)
- Military Activity Information – SUAs, alert and warning areas, military routes in use.

The following subsections describe the tools/processes that provide the above environmental information. Exhibit 5-2. Tools for Acquiring Environmental Information summarizes the tools used to acquire much of this information. More detailed information about these tools is provided in Section 6, TFM Tools and Products.

5.1.1.1 Acquire Initial Information

Daily Briefings and Position Logs are usually the initial sources of much of the environmental information needed to acquire the 'big picture'. The picture is continually updated throughout the shift through involvement in ongoing TM activities, updates posted to information status displays, and coordination with supervisors, controllers, and other facilities.

Daily Briefings conducted at the facilities include Position Briefings and 'Stand Up' Briefings at the beginning of each shift and before each shift change. FAA traffic manager position briefings are conducted according to FAO 7110.65 procedures. User ATC specialist briefings are conducted according to local company procedures.

Position Briefings are conducted immediately upon arrival for a shift, and at any time a specialist returns from a break. The traffic manager assuming the position reviews, usually in conjunction with the position incumbent, the current traffic, weather, program and general status and factors expected to influence operations in the next short while. During any shift, traffic managers are required to note any activity with operational impacts that may affect the subsequent shift and to point these out during the Position Briefing to next traffic manager.

'Stand Up' Briefings are conducted at many facilities early in the first and second shifts. A 'Stand Up' Briefing generally includes the Operations Manager, Center Weather Service Unit (CWSU), TMUs, and a minimum of one representative from each control area. 'Stand Up' Briefings include summaries/discussions of topics such as:

- Weather, including winds, icing, and turbulence
- NAVAID and equipment outages
- Call for Releases in effect
- Other TM issues
- Flow Control including MIT, speed restrictions, EDCTs, GS/GDPs
- Watch Checklist
- Staffing.

Position Logs are another source of information used upon arriving on duty and throughout the shift. Traffic managers are required to record all events and actions that have taken place during their shifts. Information included in the Logs include: equipment outages, runway status, arrival and departure rates, special activities (e.g., restricted/warning areas in use), weather trends, flow control, etc. Logs are used during Position Briefings at shift changes. During a shift, a traffic manager may consult the Position Log to refresh his/her memory about events, or the sequence of activities within events, to see what actions have already taken place and who initiated or was responsible for a particular action. Position log data is recorded in ETMS Log, TMLog, and other types of local log applications (e.g., Blue Log), according to local procedure. Specialists at FAA facilities (other than at the ATCSCC) may also review ATCSCC log data via the Intranet ATCSCC Log facility.

5.1.1.2 Acquire Weather Information

Weather plays such a frequent and critical part in the reasons for traffic flow management initiatives that considerable and constant attention is given to understanding current and forecast weather at every site across NAS. Significant weather events are a predominant contributor to delay and therefore influence a large number of short-term strategic and tactical routing decisions made by airlines, other users and the FAA alike.

The Weather Coordinator, at facilities and times where the position is filled, is assigned to collecting and/or disseminating Pilot Reports (PIREPs), Significant Meteorological Information (SIGMETs), Center Weather Advisories (CWAs), Meteorological Impact Statements (MISs), and other weather data.

Weather related duties of the TMC In Charge (TMCIC) include monitoring weather for impacts on air traffic; ensuring that SIGMETs, CWAs and MISs are disseminated correctly; that PIREPs are properly written, recorded and disseminated; that NOTAMs are handled appropriately; and that communication and display configuration for weather and other environmental hazards are supported adequately.

All traffic managers are responsible for reviewing weather information relevant to their area of responsibility and soliciting additional information as required to support specific position activities.

The tools and processes used to gather weather information include:

- Weather briefings
- Traffic Situation Display (TSD)
- Runway Visual Range (RVR)
- Aviation Weather Center (AWC) products
- Integrated Terminal Weather System (ITWS)
- Weather And Radar Processor (WARP)
- TMShell
- Other locally available weather display systems (such as Corridor Integrated Weather System (CIWS), weather channel, weather websites (NWS, AWC)).

5.1.1.2.1 Weather Briefings

Weather is such a common reason for implementing TM Initiatives that weather briefings are a major component in the briefing of any traffic manager reporting for duty. Weather briefings generally include an overview of weather which will affect the local facility's airspace and any significant destinations for flights originating in that facility, general NAS weather patterns and expected severe weather events, current and forecasted local conditions, and discussion of aviation related weather impacts that traffic managers may have to deal with in the coming shift(s). Weather related NOTAMs, MIS, and CWAs are noted.

The CWSU meteorologist or an assigned weather specialist usually gives weather briefings. Often these briefings are held in the CWSU or weather specialist area so that the TSD/CCFP and other ETMS weather overlays and CIWS/ITWS can be used to illustrate weather patterns/movement that may affect flight paths. These briefing sessions may take only a few minutes or up to 30 minutes if weather is expected to greatly affect operations. If a weather briefing is held away from the TMU, it is attended by a representative supervisor or specialist/controller from each area, who may make notes on paper, and carry the information back to the sector. Significant weather impacts and TM mitigation strategies are recorded in the logs as the shift progresses.

Each specialist briefs the incoming specialist about any expected weather events of which he/she is aware. Each specialist also conducts his/her own review of weather that may impact his/her area of responsibility using TSD overlays, the DSR weather display capabilities and all other tools/commands at his/her disposal at the position. Position weather briefings are supplemented by discussion of weather during the stand up reviews, by the weather specialist phoning or dropping by the position to notify the specialist to be aware of emerging weather events or impacts, and by the area delegated attendee at the CWSU briefings returning to the area with notes from that briefing.

The CWSU briefing is generally a 'stand up' meeting conducted in the CWSU area. The CWSU specialist first provides the current weather and the broad outlook for the next x number of hours (based on forecasts and local analysis), and then discusses particular areas/systems to watch and impacts that might be anticipated. The CWSU specialist is generally very familiar with local facility operations and therefore is well respected when it comes to weather impact analysis.

At the ATCSCC, the Weather Unit Specialist constantly monitors weather across the NAS, receives information about weather in local facilities (often from the Area Specialists) and ensures that the Strategic Planning Team (SPT) and all area supervisors/specialists are kept informed of developing weather patterns and impacts that may be anticipated. He/she provides input for the Strategic Plan of Operation (SPO) on weather matters.

At AOCs, weather briefings may be given by the specialist being relieved or by a meteorological specialist. The local procedure may be to log onto a 'dispatchers link page' (such as that maintained by the Airline Dispatchers Federation (ADF)) for weather information. In some AOC facilities, since specialists report for work at regular shift times, weather briefings are delivered at the start of the shift via an intercom announcement. The latter may be supplemented by automated delivery of METARs, TAFs, SIGMETs, PIREPs, etc. specifically applicable to the position responsibilities. In addition, where the AOC has contracted for services from an ASDI vendor, they are often provided with weather information as a part of the interface they receive (such as Flight Explorer). Some AOCs have also developed their own interfaces to receive ASDI information, packaged with WSI or other weather source data.

5.1.1.2.2 Traffic Situation Display (TSD)

The TSD provides the following weather information:

- METARs /TAFs for airports
- Jet stream graphics showing wind direction, speed, and altitude
- NOWRAD (radar determined precipitation data)
- Radar tops showing the altitude of cloud tops in precipitation areas
- Lightning
- CCFP
- RVR.

Traffic managers can choose which of the above TSD weather information to display by making selections from the TSD pull-down Weather menu. All of the selected information, except for airport METARs/TAFs and RVR data, are overlaid on the TSD map elements. METARs and TAFs are displayed as text. RVR data is displayed in tabular format. Refer to Section 6.1.23.2.4 Weather for a discussion of the weather information available on the TSD and how it is displayed.

At Washington ARTCC (ZDC), Southern CAL TRACON (SCT), Chicago ARTCC (ZAU), and many other facilities, traffic managers do not use the CCFP overlay, although the CCFP is usually displayed at the supervisor position, since he/she participates in the SPO and must refer to that information. In congested northeast airspaces, traffic managers are more concerned with weather on their arrival and departure paths since, in these more tactical environments, they require an accurate real-time picture of local convective activity, along with short-term forecasts, in order to anticipate traffic flows in smaller airspaces.

A replay of historical flight, weather, and alert data on the TSD is also available. Traffic managers may occasionally review events which occurred at a certain time and/or place in order to compare current activities with those of the past. During the replay, traffic managers can issue other TSD commands as usual, however, requests for data from ETMS databases return current rather than historical data. During a busy severe weather shift, however, there is usually little time to examine historical data, though this feature may be used for briefing purposes or to settle a question of trends that may precede a flow issue.

For further information about the TSD, see Section 6.1.23.

5.1.1.2.3 Runway Visual Range (RVR)

The RVR system at an airport reports Runway Visual Range values from 0 to 6500 feet that, roughly speaking, represent the distance that a pilot is able to see down the runway. For a fully instrumented runway, RVR values are given for the touchdown, midpoint, and rollout portions of the runway, along with an indication of whether the values are increasing, decreasing, or stationary. In addition, the status of edge and centerline lights is given. RVR data, which represents an average of the values over the last minute, is received on a continuous basis every two seconds from airports equipped to provide this data to ETMS.

The users of RVR data include TMU specialists, airlines, and general aviation. The more tactical the operation, the more likely that RVR data at local airports will be useful. Continual monitoring of RVR data may be required when weather conditions are deteriorating at a particular airport or when delay programs are in place awaiting weather to lift.

RVR data is displayed by ETMS on the TSD (to traffic managers), and is also available on the RVR public website (to FAA facilities, users and the general public) and the Volpe CDM DataGate website (for CDM airlines and Volpe staff).

RVR data for specific airports can be requested on the TSD via the Weather functions. The RVR Report command is used to display and print Runway Visual Range information. An RVR report can be generated for any (single) specified airport. RVR data displayed on the TSD is shown in a text box that does not update, until the next time RVR data for the same airport is requested.

The RVR information on the CDM DataGate website is a direct link to the RVR public website. Users access the RVR public website to view RVR data graphically or to monitor more than one RVR airport simultaneously. Data for up to 16 airports can be displayed at once, provided the monitor has sufficient resolution to handle that number.

RVR data display was not observed at the ATCSCC. In TMUs, RVR data is often displayed only at the Supervisor or Weather Unit position where a number of RVR windows may be open to cover the major departure and/or destination airports. These may be configured on an ad hoc or regular basis, depending on weather conditions or local procedure requirements.

RVR data collection and dissemination has long been considered a high priority NASSI data item with CDM in mind. A number of AOCs use RVR data since the airlines are vitally concerned with local weather and runway conditions that can greatly affect their operational schedules. While this data is not considered operationally accurate, its availability does reduce phone calls to local facilities from airlines.

For further information about RVR, see Section 6.1.20.

5.1.1.2.4 Aviation Weather Center Products

The Aviation Weather Center (AWC), through its public website at www.awc-kc.noaa.gov, issues warnings, forecasts, and advisories of hazardous weather for aviation interests. The AWC website includes issued products (e.g., Airman's Meteorological Advisory (AIRMETS), SIGMETS for Icing/Turbulence/IFR, Significant Weather Programs) as well as forecast guidance (e.g., model data, satellite imagery, radar data) designed to help give the pilot access to the same data sources that the meteorologists use. Experimental forecast products are also available for evaluation. Specialists at airlines use this site and/or the Dispatcher's website to supplement their weather information. Often airline specialists in turn supplement the weather information acquired by ATCSCC specialists.

5.1.1.2.5 Integrated Terminal Weather System (ITWS)

The Integrated Terminal Weather System (ITWS) is an automated weather system that provides near-term (0-30 min.) prediction of significant terminal area weather. ITWS integrates data from radars, sensors, and automated aircraft reports. It generates products including wind shear and microburst predictions, storm cell hazards and lightning information, and terminal area winds aloft. ITWS can differentiate between real weather radar returns from those caused by anomalous propagation.

ITWS is available within AOCs at the head dispatch desk, meteorologist position, ATC coordinator position (and sometimes at ground operations control positions) via dedicated situation displays, on wall projections, or via the ITWS website which depicts terminal and 200 nautical mile graphics. ITWS website images may also be extracted for display at individual positions on non-dedicated terminals.

Dispatchers and TMU traffic managers use ITWS' high quality terminal convective activity information (with prediction times of 20-60 minutes) to provide short-term forecasts in their tactical environments. ITWS can predict up to 20 minutes in advance. It provides a fully integrated set of terminal weather products, highly accurate near-term predictions of the weather including hazardous weather projections overlaid on graphic situation displays, and tailored safety alerts.

ITWS one-hour forecasts are now also being fed into the proof of concept Route Availability Planning Tool (RAPT) tool to provide weather predictions to assist specialists in determining departure routing during poor weather. Although RAPT is installed in the N90 TMU, it was not operational during the Audit Team's site visit.

For further information about ITWS, see Section 6.4.6. For further information about RAPT, see Section 6.4.13.

5.1.1.2.6 Weather and Radar Processor (WARP)

WARP receives and consolidates weather data from multiple sources into a single database and analyzes, generates, and displays specialized value-added aviation weather products to support en route air traffic control operation. The TMUs and the CWSU meteorologists at the ARTCCs and the ATCSCC are the primary users of WARP. WARP provides current and long-range forecast weather conditions for strategic planning and developing hazardous weather conditions for tactical-decision assistance.

For further information about WARP, see Section 6.4.11.

5.1.1.2.7 TMShell

TMShell allows the manager to execute many of the non-graphical commands available in the TSD without any of the graphical displays (overlays, boundaries, flights, etc.) ever appearing. TMShell commands are available for requesting text METARs and TAFs. Using TMShell commands for weather information is not a common practice at the TMUs.

For further information about TMShell, see Section 6.1.22.

5.1.1.2.8 Corridor Integrated Weather System (CIWS)

CIWS provides traffic managers at the ATCSCC, ZOB, ZDC, ZAU, ZBW, ZNY, ZID, N90, ORD, DTW, PIT, CLE and CVG with two-hour, high resolution forecasts to predict storm locations and tops as well as growth and decay animations. Airlines also have access to CIWS via the Internet and CDMNet, as well as through dedicated displays. CIWS is still a proof of concept product at present.

Traffic managers use CIWS to supplement the CCFP with a more tactical view, allowing them to use available airspace more efficiently during bad weather, reducing delay as a result.

For further information about CIWS, see Section 6.4.2.

5.1.1.3 Acquire NAS Status Information

Changes to NAS elements including NAVAID/radars, runways, telecommunications equipment, etc. have a significant impact on NAS capacity and thus on traffic flow management. The local Air Facility (AF) system engineer forwards outage information to the TMU either on paper or on the phone. At some sites, the AF personnel come to the shift briefings and provide overviews of current and anticipated outages.

Besides getting the information verbally from briefings and during coordination activities with peers and supervisors, TMUs acquire updated information concerning capacity constraints via the following tools:

- ATCSCC Website
- ETMS Log/TMLog
- NOTAMs
- SAIDS.

5.1.1.3.1 ATCSCC Website

The ATCSCC website OIS Page provides real time information on some NAS elements. Some pages that provide essential information to TMUs are:

- The East and West Directories links provide a path for accessing sector-specific airport information. Information may be retrieved by “drilling down” either through the navigation frame entries or through the geographic maps in the target frame. As opposed to text list choices in the navigation frame, the maps provide users with a geographical perspective of the ATCSCC sector, ARTCCs, and location of airports within the ARTCCs. When the desired airport is located, the Airport Arrival Rate window is displayed. This window lists the selected airport’s landing and departing runways, airport arrival rates, and aircraft Category Minimums.
- The Runway/Equipment Info table is used to track equipment outages and construction for major airports that may result in air traffic delays. The list is not a complete list of all runway/equipment status. Users are instructed to consult the current NOTAMs for a complete list. Each table entry includes the facility and a brief, free form problem description.
- The Airport Closures table lists the airports that are closed. Each table entry includes the airport, date/time the airport closed, reason the airport closed, and date/time the airport is expected to reopen.
- The East/West Flight Check Info table includes information on Flight Checks that are operating at airports located within the East/West Sectors of the ATCSCC. Periodic inspections are made of NAS navigational aids. Specially instrumented aircraft performs some of these inspections. In order for the flight check instruments to make accurate measurements, certain phases of the flight check must not be interrupted. Because of this, flight inspections can cause minor air traffic delays. Each table entry includes the airport that will be flight checked, scheduled Zulu date/time of the flight check, scheduled local date/time of the flight check, and a brief description of what will be checked.

Further information about the resources available to specialists via the ATCSCC Intranet website is available in Sections 6.1.1 (overall ATCSCC Intranet Website description) and 6.2.5 (OIS).

5.1.1.3.2 ETMS Log/TMLog

ETMS Log/TMLog or other local log tools are used by traffic managers to record information such as equipment outages (planned or unplanned), airport conditions/status, airport activities (e.g., snow removal, vehicles on runway, etc.), and runway closures (including times and expected impact). The Logs provide the necessary information about the NAS environment for subsequent shift specialists and for later use during incident investigations if necessary.

Further information about ETMS Log can be found in Section 6.1.12. TMLog is further described in Section 6.1.21. Information about some locally developed log tools is available in Section 6.3, Local TFM Tools.

5.1.1.3.3 NOTAMs

NOTAMs, both local and national, published and 'unpublished', report the status of any situation or condition considered hazardous to flight. These conditions may include NAVAID, equipment, facility, frequency, or runway outages or operational changes as well as general aviation flight area restrictions (including itinerant airspace reservations for military and special events), all of which can affect capacities at, and in airspace surrounding, local facilities. NOTAMs can be a source of valuable aeronautical information regarding runway conditions such as runways being closed due to ice or snow removal operations. NOTAMs also provide information about equipment such as the Low Level Wind Shear Alert System (LLWAS) or Terminal Doppler Weather Radar (TDWR) being unusable.

Every 28 days, Air Traffic Publications (ATA-10) publishes the Notices to Airmen Publication (NTAP). In between publications, NOTAMs are generated which are either of short duration or have not yet been included in the publication. Short term NOTAMs are generated in response to dynamically changing environmental conditions. These are usually received and printed out in Summary form and as individual NOTAMs (often at the Flight Data Communications office within ARTCCs).

ERIDS is installed in the TMUs at ZLC, ZJX and ZBW, and will be sending pertinent NOTAMs to TMU positions in the near future. Some facilities have locally developed programs to electronically sort and deliver NOTAM information to sectors using the Host. At other sites, NOTAM information is displayed via ESIS or is distributed to positions on paper.

5.1.1.3.4 SAIDS

SAIDS, referred to also as IDS4, IDS5, and ACE-IDS, are display systems from Systems Atlanta, Inc. and Systems Management, Inc. that provide information including: Automated Surface Observing System (ASOS), Digital Altimeter, Low Level Wind Shear Alert System (LLWAS), Runway Visual Range (RVR), Terminal Doppler Weather Radar Wind Shear (TDWRW) as well as runway status. The information that can be displayed is dependent on each site's specific implementation.

Further information about SAIDS can be found in Section 6.3.4.

5.1.1.4 Acquire Military Activity Information

Many military activity areas are static areas that are in operation regularly and have procedures for operations defined in Letter of Agreements (LOAs). For a number of these areas, there are agreements between the military and the FAA allowing the FAA to use these areas during bad weather for reroutes. One such area is VACAPES, off the eastern seaboard. For this SUA, the FAA and U.S. Navy have signed a LOA that describes warning area airspace (Northern Florida to Maine) coordination during severe weather events. Based on airspace availability, additional routes may be utilized during severe weather events. Depending on the route through the airspace, an evaluation of aircrew and aircraft qualifications may be necessary.

This information may be acquired via the position briefing, logs, Enhanced Status Information System (ESIS) displays, paper record distributed from the area supervisor, or on the phone as situations change or are forecasted to change.

The traffic manager needs to know what military activity areas will be in use during the next 24 hours. He/she needs to know the times of activation, the type of any active area, the location and size of active areas, and whether they can be used by domestic traffic or must be completely avoided during their 'hot' periods.

The Military Coordinator maintains a paper list of active areas. He/she provides a list of SUAs expected to be in use (to go 'hot'), on paper, to the TMU and sectors, usually 24 hours in advance. A list of warning areas (not included in SAMS data) is sent to the TMU from the ATCSCC daily.

Mission Coordinators are responsible for liaison between the military and the TM unit. Their responsibilities include monitoring of all types of military special use airspaces (alert areas, Air Traffic Control Assigned Airspaces (ATCAA), controlled firing areas (CFA), military operations areas (MOA), restricted areas, warning areas and prohibited areas. In addition, they monitor and communicate the status of military training routes (MTR) such as IRs, VRs, and SRs, aerial refueling (AR), and stationary/moving ALTRVs. They communicate current military activities to those who will be affected through briefings and may be responsible for updating ESIS displays or local status information system pages to reflect current and near term military activities.

TMLog is used at some facilities to record or amend SUA activity. The list of SUAs is currently manually entered at each facility where TMLog is installed. The traffic manager selects from the predefined list of SUAs appropriate to the controlling facility, the type of special use airspace it is being declared as, and enters the particulars of start/end date/time (or UFA). They may also enter other specifics such as altitude boundaries, and separation type.

See also Section 5.3.2, Plan for Special Government Events, for further information regarding military activities. A description of TMLog can be found in Section 6.1.21. SAMS is discussed in Section 6.4.7.

5.1.1.5 Tools Summary

Exhibit 5-2. Tools for Acquiring Environmental Information summarizes the tools most often used by TMUs to acquire information about the environment. More detailed information about these tools is in Section 6, TFM Tools and Products.

Exhibit 5-2. Tools for Acquiring Environmental Information

TFM Tool	How Tool is Used For Acquiring Environmental Information	Reference to Functional Audit Tool Description
TSD	Regional view provides the big picture for traffic flows and density, as well as weather in and surrounding the local area. Allows traffic managers to request METARs and TAFs. Provides CCFP overlay.	6.1.23
DSR ACD/FDAD	Provides a tactical view for validating general traffic picture. Provides position relief checklist.	6.4.3 (DSR) 6.4.1 (ACD) 6.4.5 (FDAD)
FSM	Timeline window (and other FSM functions) provides a view of AARs and ADRs at a glance for monitored airports.	6.1.14
DSP (if available)	Lineup lists give an indication of where traffic is coming from and what the mix is, flows (which departure fixes are in use and what loading to expect), extent of current demand and current delay.	6.1.5
TMA or CTAS Terminal (if available)	Provides a view of arriving traffic: density, mix, sequence, spacing, paths to arrival fixes, undesirable flight path deviations, particularly for parallel runway operations.	6.4.9 (TMA) 6.3.5 (CTAS Terminal)
OIS SAIDS	Provides status information about restrictions in place, airport conditions and outages, position relief checklist display, SUA information, access to other functions (TMC Tools).	6.2.5 (OIS) 6.3.4 (SAIDS)
ETMS Log TMLog Local Logs	Provides reference for briefings, daily review and planning meetings. Allows reconstruction of events during past shifts. Allows recording of runway changes, equipment outages, etc. Logs are printed out on Form 7230-4 for facility record of operations.	6.1.12(ETMS Log) 6.1.21 (TMLog)
RVR ITWS WARP CIWS	Provides local, tactical weather and runway condition picture for ARTCCs, TRACONs, and towers.	6.1.20 (RVR) 6.4.6 (ITWS) 6.4.11 (WARP) 6.4.2 (CIWS)
SAMS	Military information system that provides a (seldom used) list of some types of military areas scheduled for use in the next 24 hours.	6.4.7 (SAMS)
Websites: -ATCSCC -Airline dispatcher -Weather service	ATCSCC Website: Provides SPO contents, AADC, airport status, etc. Airline Dispatcher Website: Comprehensive list of links to a variety of weather information sites, and other information useful for briefing and updating purposes. NWS/AWC Website: Links to the wide variety of weather data/presentations provided by the National Weather Service.	6.1.1 (ATCSCC) 6.2.1 (AADC)
DOTS	Provides a general oceanic traffic picture (inbound/outbound from the NAS). Oceanic track generation capabilities. National security purpose: advance warning of undesirable flights about to violate NAS airspaces.	6.4.4

5.1.2 Determine Resource Capacities

Subsequent to acquiring the current background information about the NAS, the traffic manager assesses NAS capacities, specifically system capacities at the airport, fix, route, and sector levels. TM personnel review predetermined capacity data for each element in their particular TM domain and adjust those numbers in accordance with the current and projected airport and airspace status, weather, and aeronautical constraints.

This section describes the processes, tools, and data used at both national and local traffic management facilities to determine and change current and near future NAS capacities, as well as to preview potential effects of capacity changes.

The concepts of 'capacity' and acceptance rates, TMC procedures, and the use of tools such as ETMS/TSD and FSM as capacity management tools are described in this section.

The following topics are discussed in these subsections:

- Capacity Concepts
- Constraints to Capacity
- Monitoring Capacity
- Monitoring and Changing Capacity Values
- Tools for Monitoring and Changing Capacities.

Tools described in the following subsections are also presented in Section 6, TFM Tools and Products.

5.1.2.1 Capacity Concepts

'Capacity' is the maximum number of aircraft that a facility can safely transition through its boundaries or over a given element (airport, fix, intersection, runway threshold, etc.) during a given period of time. It is usually measured as a flow rate or the number of aircraft per hour. Factors that affect airport capacity include weather, number of runways/gates, downstream constraints, landside limits (terminals, road access), environmental restrictions (noise and emissions), controller staffing level, and safety. The safety aspect of capacity, from departure runway to destination runway, is also based on the need to impose minimum separation standards at each element. Some factors such as weather conditions, runway availability, and capacity changes of nearby facilities cause dynamic changes to airport capacity.

The arrival acceptance rate is a general term for the number of arriving aircraft that a fix, sector or route can accept per hour. The most crucial acceptance rate, the Airport Acceptance Rate (AAR), is the one most often used for TM purposes. AAR is a composite number which represents the ability of the airport to accept traffic, as measured by 'wheels on' time when landing (i.e., the time the aircraft wheels touch the runway). The AAR value is used to calculate the desired interval between successive arrival aircraft.

The airport departure rate (ADR) is the number of aircraft that can depart an airport in an hour, as measured by 'wheels off' time. This value is used to calculate the desired interval between successive departing flights. Departures are more often delayed by ground delay programs or reduced AARs at destinations rather than at origins.

AAR is usually a more critical measure of capacity than ADR. AARs often have to be reduced due to poor visibility, high/gusty winds/shear, or heavy precipitation. When the wind changes, it is often necessary to also change runway configurations. Each runway also has a different associated acceptance rate, which then affects the airport acceptance rate. If a particular runway is not long enough for some types of traffic (i.e. heavy jets) or if it lacks ILS capability, the need to use that runway (due to wind shifts or NAVAID outages perhaps) can drastically affect acceptance rates for the entire facility. In addition, it is difficult to maximize acceptance rates when weather deteriorates and a switch from VFR to IFR separation standards must be made. For these reasons, the AAR for an airport largely depends on the runways in use and their individual acceptance rates at any given time.

AAR is generally the defining number for flow management operations since most programs and initiatives (with the exception of ground stops) are based on arrival rates. If an AAR cannot be maintained for any length of time, consideration is given to reducing it.

ADRs are also affected by weather, and outages, but generally less so than AARs, unless there is severe weather in close proximity to the airport. ADRs are most affected by runway availability and configurations, since it is more of a priority to land already airborne traffic that may be stacked up than to use a runway for departures. Usually, however, the ADR is not a limiting factor for capacity versus demand management, since most TM delay programs are based on arrival rates rather than departure rates.

5.1.2.1.1 Optimum and Reduced AARs and ADRs

In aviation, there are two types of capacities, optimum and reduced, defined for each fix, sector, and route, determined through analysis and experience.

- Optimum AAR and ADR are for use under good weather conditions (e.g. visual approaches are possible, ceiling and visibility are unlimited).
- Reduced AARs and ADRs (one or more) are for use under poor weather conditions (e.g. IFR approaches are necessary, ceiling and visibility is less than VFR).

Controllers and traffic managers generally strive to match actual fix, sector, or route throughput to the current AAR setting, whatever that may be. In most cases however, actual is usually less than, but close to, the current AAR. This is true unless front loading is being employed to bring flights in faster than the prescribed rate for short periods of time to clear up arrival backlogs and reach a reset AAR faster after a ground delay program has been in place; or there have been short term local weather events which prevented flights from arriving at the particular element as they should have.

Capacity is integrally linked with demand and capacity value settings, and during any day may therefore be affected by demand as well. For instance, capacity values may be limited for short periods by more demand than the airport infrastructure can bear (e.g. numerous flights sitting on the tarmac unable to find a gate or after a weather event, the lineup of flights ready for departure is very long). The capacity for the airport (either or both of AAR and ADR depending on the circumstances) may be lowered until the demand backlog can be cleared up.

5.1.2.2 Monitoring Constraints

Capacity management is based on the analysis of physical constraints (such as runways, traffic mix, and the size of usable airspace for traffic movement) and weather conditions. Severe weather is generally the most common constraint to capacity. Other factors that can affect capacity include:

- Runway configuration (current and projected)
- Runway status (e.g. construction, closure, condition of runway surface)
- NAVAIDs and other equipment outages
- Traffic (volume, fleet mix)

During periods of high activity or when metering is in effect, these factors are monitored constantly to ensure that the AAR (or ADR) is accurate. To monitor constraints that may cause AARs to be reduced, TMCs use most of the tools at their disposal, depending on their type of operations. They may receive verbal reports from other facilities or users (pilots for PIREPs, AOCs, AF for outages, etc.). NOTAMs, Center Weather Advisories (CWA), and Meteorological Impact Statements (MIS) messages may arrive on paper at the position or be verbally communicated. Information about other factors that can affect enroute or local capacities may come in the form of advisories sent out from the ATCSCC relaying Volcanic Ash Reports, Standing Wave Reports, or the SPO. Other information may be received through General Information (GI) or ERIDS messages. TVs are also used at the ATCSCC to monitor the weather channel.

Once acquiring the ‘environmental background picture’, the traffic manager begins mentally to form a picture of how the constraints may affect the base capacities. For instance, if there is a large and potentially severe weather front moving across a broad area from west to east at a rate of x miles/hr, capacities at the airports along that front in the next x hours may be affected.

Traffic managers, from experience, may know the base capacity for a particular NAS element (such as a major airport) by heart, however, a new traffic manager may have to look for that information, and any traffic manager may have to look for the base capacity for non-major NAS elements. The elements in which there is most interest are the ones that are normally critical to flows between major destinations during busy periods.

The lower the minima, the higher the need for availability for all airport facilities/NAVAIDS/lighting, etc. What might not be a critical outage during good weather may be critical when weather is poor. Therefore it is important to have a good understanding of current and predicted weather patterns, as well as current and planned equipment/runway outages in order to assess the potential for flow problems as early as possible. For this reason, TM personnel also need to acquire background information about NAS infrastructure status at the start of a shift. See Section 5.1.1 for further information about this process.

Most of this information is derived initially through verbal means. On a regular basis and throughout the day, specialists at ARTCCs report local outages to the ATCSCC. They in turn may have received this information from their associated towers or terminal facilities.

Airways Facilities (AF) personnel in the NOCC located at the ATCSCC monitor the NAS for outages and other equipment problems. They also have three centralized regional facilities, located in the ARTCCs/TRACONs at ZKC, ZTL and SCT. Though AF has automated monitoring and data collection systems, there does not however at the current time, appear to be much, if any, automation associated with the distribution of outage/equipment problem information between AF and ATC or TMUs.

Flight Service Stations (FSS) issue NOTAMs for scheduled outages. These NOTAMs are received at the facilities generally by the Flight Data Communications Specialists and, in many cases, distributed to area supervisors on paper. Supervisors assess the relevance of these NOTAMs to their area/sectors and may inform controllers/specialists verbally, on paper or via Enhanced Status Information System (ESIS), or by entering the information into IDS/SAIDS or the Operational Information System (OIS). ERIDS will soon provide for the automated receipt, request, and display of relevant NOTAMs directly at a position, in both operational areas and in the TMU.

The impacts of major outages are part of the analysis and discussion during the Strategic Plan of Operations (SPOs) initiated by ATCSCC every two hours throughout the day.

The TFM tools used to monitor constraints are summarized in Exhibit 5-3. Tools to Monitor Constraints. These tools are described in Section 5.1.1, Acquire Environmental Information, as well as in Section 6, TFM Tools and Products.

Exhibit 5-3. Tools to Monitor Constraints

TFM Tool	Functions For Monitoring Constraints	Reference to Functional Audit Tool Description
TSD	Weather: CCFP, weather overlays and weather requests (METARs / TAFs) Traffic	6.1.23
DSR (if ARTCC) or ACD/FDAD (if TRACON)	Weather: WARP KDVT and DSR: Traffic KDVT: GI messages	6.4.3 (DSR) 6.4.1 (ACD) 6.4.5 (FDAD)
FSM	Traffic demand and capacity values	6.1.14
DSP (if available)	Local departing traffic and capacity values, Apron/Gate Status	6.1.5
TMA or CTAS Terminal (if available)	Local arriving traffic and arrival fix capacity values	6.4.9 (TMA) 6.3.5 (CTAS Terminal)
Information Status tools (IDS/SAIDS, ESIS, OIS)	Runway Configurations, Runway Status, Apron/Gate Status, NAVAIDS and other Equipment outages	6.3.4 (SAIDS) 6.1.7 (ESIS) 6.2.5 (OIS)
ATCSCC website	Advisories, NAVAIDS and other Equipment outages	6.1.1
ERIDS	Runway Configurations, NOTAMs/CWA/MIS, Apron/Gate Status, NAVAIDS and other Equipment outages	6.4.12
TMLog	Runway Configurations, Runway Status, Apron/Gate Status, NAVAIDS and other Equipment outages	6.1.21
ETMS Log	Runway Configurations, Runway Status, NAVAIDS and other Equipment outages	6.1.12
RVR	Runway Status	6.1.20
Other weather presentation systems (WARP/CIWS/TDWR/ITWS/ LLWAS)	Integrated short term local current and forecast weather products	6.4.11 (WARP) 6.4.6 (ITWS)

5.1.2.3 Monitoring and Changing Capacity Values

During the day, the East and West Specialists at the ATCSCC are continually in contact with ARTCC facilities under their jurisdiction to monitor current capacities. Each ARTCC in turn is in communication with its underlying TRACON / ATCT facilities to assess the need for changes to capacity settings. The need for, and the amount of, adhoc capacity change to any NAS element are therefore determined through a continual assessment and communication process. Often the need is historically determined based on the experience of the traffic managers and controllers in dealing with previous similar weather patterns or constraints.

When sending out a GDP, ATCSCC and NavCanada traffic managers enter airport acceptance rates to reflect current conditions. ETMS maintains a table of the current values, and sends both changed and default AARs and ADRs back to all FSM users via the ADLs. Once a GDP has expired / been cancelled, changed acceptance rates for the GDP airports return to their base level automatically, and remain there until a new program goes into effect and they (one or both) are changed once again. The base values are maintained in a static file, which can be changed at the ATCSCC, and are then forwarded to Volpe for inclusion in the next 56-day update.

Monitor Alert parameters, which are currently described in ETMS documentation as 'alert thresholds', are depicted as 'capacity' bars on the MA graphs, and can be changed using the Capacity Set (CAPS) command, are not really 'capacities' at all. They represent a negotiated value (which may indeed be the same as an FSM capacity at times) against which traffic managers can set alerts. These are the values retained by ETMS as 'today's values' and 'default values', and which are refreshed by ETMS daily. These will henceforth be referred to as *MAP* values. The default MAP values are maintained in a static file that can be changed at Volpe only.

5.1.2.4 Tools For Monitoring and Changing Capacities

The following national TFM tools allow traffic managers to view and change capacity or alert threshold (MAP) values, current and / or default:

- Traffic Situation Display (TSD) / Monitor Alert (MA) – alert thresholds (MAP)
- Flight Schedule Monitor (FSM) – AAR and ADRs
- Departure Spacing Program (DSP) – DSP departure fix rates
- Traffic Management Advisor (TMA) – TMA arrival fix rates
- TMLog – for log and coordination purposes only.

FSM uses ETMS maintained capacity values. Monitor Alert Parameters (viewable via the TSD) also use values maintained, separately from the FSM values, within ETMS. DSP and TMA maintain their own adapted sets of values, adjusted by local controllers / specialists. The use of these tools relative to capacity values is summarized in the following subsections. Further information on each tool is also provided in Section 6, TFM Tools and Products.

5.1.2.4.1 TSD/MA

The TSD MA function provides the ability to set the monitor alert thresholds (i.e., MAP values) for critical airspace elements. Exhibit 5-4. TSD Alerts Menu shows the TSD Alerts Menu. Note: Monitor Alert Parameters are not capacity values, are not AARs and ADRs, and, at any given time, may differ from FSM AAR and ADR values.

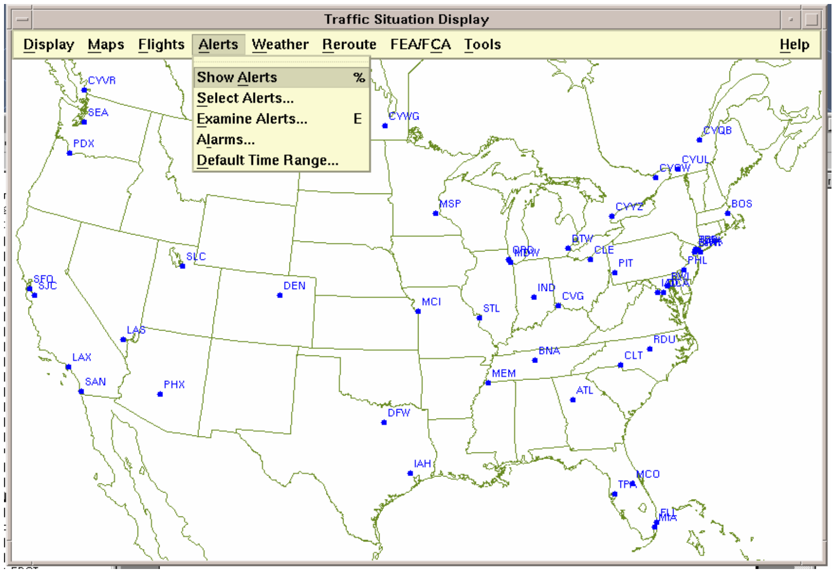

Exhibit 5-4. TSD Alerts Menu

ETMS maintains a list of approximately 6,000 airports, sectors, and fixes within the NAS but only a subset of those elements are ‘monitored’. Monitored elements have alert threshold values associated with them. An alert threshold is defined as the level of traffic demand required at an element for it to be brought to the attention of a traffic manager. Monitor Alert function’s alert thresholds are retained by ETMS as today’s threshold value and nominal (default) threshold value. These threshold values are refreshed daily at 0800 Zulu, when ETMS uses the nominal thresholds to reset today's (MA alert threshold) values to the default set. Every minute, ETMS uses today's values to check traffic demands. If a predicted demand count exceeds a threshold value, ETMS generates a Monitor Alert for that element and displays the alert on the TSD.

Monitor Alert and FSM are used in tandem in some facilities to help traffic managers balance capacities with demand. Alert thresholds can be changed locally for any local airspace fix or sector. The MA alert threshold for an arrival fix or arrival sector may be set deliberately below the (FSM defined) AAR to warn TMCs when there is traffic buildup (demand increase) which may cause a problem at a particular fix.

While ATCSCC specialists have authority to change MAP values for any NAS element, this is rarely done at the present time.

5.1.2.4.2 Flight Schedule Monitor (FSM)

Default AARs and ADRs are defined for each airport monitored by FSM. Default capacity values cannot be changed by TMSs directly, but are done by ATCSCC System Administrators who make capacity value changes to ETMS during the normal 56-day update cycle.

Changes to AARs and ADRs during the day occur as the result of ATCSCC (or NavCanada) specialists entering changes in conjunction with delay programs through FSM.

Traffic managers at local facilities can model the impacts of a change in an AAR on a proposed program, but cannot actually change the AAR.

FSM's Timeline function displays current or default AARs and ADRs for airports monitored by FSM. Exhibit 5-5. FSM Timeline - AAR Data Display illustrates a flight count for a particular group of flights within a particular time period.

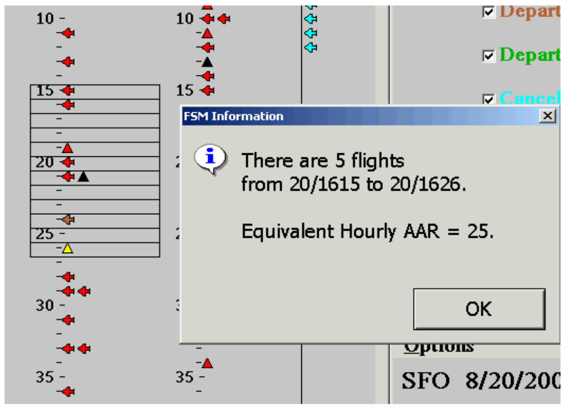

Exhibit 5-5. FSM Timeline - AAR Data Display

The FSM Timeline window also shows flight count results indicating AAR as affected by current demand.

AAR and ADR values are displayable by FSM in either live or historical mode, as shown in Exhibit 5-6. FSM Graph – Current AAR Setting. The white line indicates the current AAR setting and the orange line indicates the current data time. Traffic managers use historical mode to review how a GDP/GS program actually worked, or how demand and capacity were balanced during a particular time period.

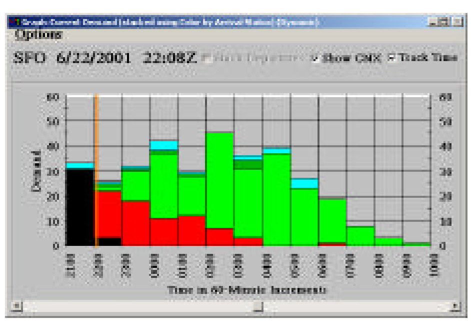

Exhibit 5-6. FSM Graph – Current AAR Setting

In addition, FSM allows traffic managers to locally model impacts of proposed Ground Delay Program (GDP)/Ground Stop (GS) initiatives under temporarily changed acceptance rates. Since GDP and national GS programs are initiated and managed only from the ATCSCC, changes to AAR/ADR during a GDP/GS program are made by the TMSs only. The revised values are sent to all FSM users by ETMS via the Aggregate Demand Lists (ADLs), which contain the current AAR and ADR settings for the particular airport with which the ADL is concerned. Exhibit 5-7. FSM Ground Stop Template shows how AARs can be set up by one-hour segments when issuing a Ground Stop.

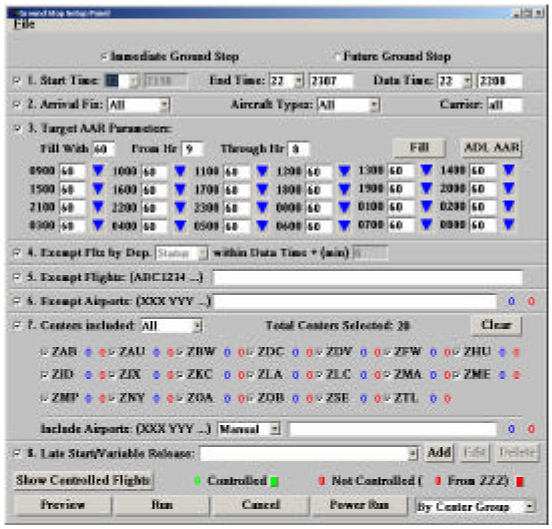

Exhibit 5-7. FSM Ground Stop Template

5.1.2.4.3 Departure Spacing Program (DSP)

The Departure Spacing Program (DSP) is currently being developed for the FAA as a proof-of-concept prototype for implementation in the Northeastern U.S. Air Traffic Corridor. DSP evaluates aircraft departure flight plans at participating airports, models projected aircraft demand at departure resources such as first and second departure fixes, and provides windows of departure times to controllers. DSP displays current and predicted departure fix capacities as well as allows traffic managers to make departure fix flow rate adjustments.

5.1.2.4.4 Traffic Management Advisor (TMA)

The Traffic Management Advisor (TMA) is a strategic planning tool for en route controllers and traffic managers in the ARTCC, TRACON, and Tower. TMA affects traffic flow and planning of aircraft operating in en route airspace. It provides computer automation to enhance arrival sequence planning and the efficiency of air traffic operations in the extended terminal airspace surrounding major airports. TMA displays current and predicted arrival fix capacities as well as allows traffic managers to make arrival fix flow rate adjustments.

5.1.2.4.5 TMLog

TMLog provides for recording of AAR and ADR values for runways. The AAR and ADR values do not necessarily reflect actual values or ETMS defaults. The traffic manager enters these values manually by using the TMLog configuration templates as shown in Exhibit 5-8. NTML (TMLog) Multiple Airport Configuration Template.

Exhibit 5-8. NTML (TMLog) Multiple Airport Configuration Template

AAR and ADR changes are recorded along with other configuration changes, including airports, approaches, arrival runways, and departure runways. As with other data within TMLog, this information can be shared with other TMLog users over the ETMS network.

5.1.3 Determine Current and Predicted Demand Profile

This subsection describes the processes, tools, and data used at both national and local traffic management facilities to assess traffic demands (in terms of numbers, timing, and interactions) that will be placed on various NAS elements over the next few hours. Discussion includes how the current traffic situation is visually acquired (situation displays) as well as an overview of the system data and mechanics that support that activity. In addition, the basics of demand determination / processing are detailed.

5.1.3.1 TFM System Users and Demand Determination

Both FAA service providers and airline users need to determine flight traffic demand on a continual basis. Each uses a different process and toolset to support that determination. Both are discussed below.

5.1.3.1.1 FAA Service Providers

The traffic manager maintains a constant view of current and projected flight demand by accessing multiple sources of information as depicted in the following exhibit: Flight Demand Situation Awareness. These sources include the following items:

- ETMS-Based Displays (including TSD / WSD, MA, flight counts, flight lists and FSM; refer to Section 5.1.3.2 below)
- Radar-Based Displays (may be either DSR, ACD, FDAD, or DBRITE depending upon the type of facility in which the TMU is located)
- Internal Briefings (including change of shift, fixed, and ad hoc briefings)
- Status Displays (indicates current TM initiatives in effect)
- FDIO Printer (provides hard copy of TM advisories).

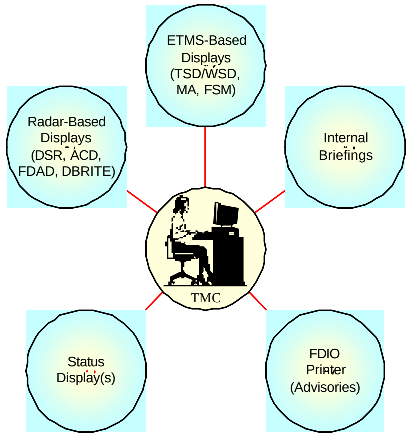

Exhibit 5-9. Flight Demand Situation Awareness

Regardless of the facility in which the traffic manager works, the process used for gaining traffic demand situational awareness is the same. A traffic manager takes over a TM position due to a shift change or to allow another traffic manager to take a break. When this occurs, a position briefing is conducted between the current traffic manager and the substitute to allow the latter to quickly acquire the traffic demand picture. The briefing is an information exchange and is conducted according to a checklist to ensure that all pertinent information is covered. The briefing points out where traffic demand needs to be monitored and why. ATCSCC position briefing checklists are available online on the OIS web site, but the location of other TMU position briefing checklists varies by facility. Some facilities store the briefing checklist online whereas others tape a hardcopy of the checklist to the side of a workstation.

During the position briefing, the traffic manager currently staffing the position often points to one of the tools available at the position to show where the traffic demand currently needs to be monitored and managed. Depending on the situation, the traffic manager may point to one or more of the items listed in the Sample FSM Arrival Demand Barchart exhibit below. The list below describes how each of the tools is used during the position briefing.

- TSD: to show a clumping or steady stream of flights towards a particular area or fix as well as the routes being used for severe weather avoidance.
- MA: to point out where traffic counts are predicted to be high in the near-term future for airports, sectors, and/or fixes. The diagram below illustrates the MA timeline window available from the WSD and CCSD web pages. The TSD MA window has a similar appearance.

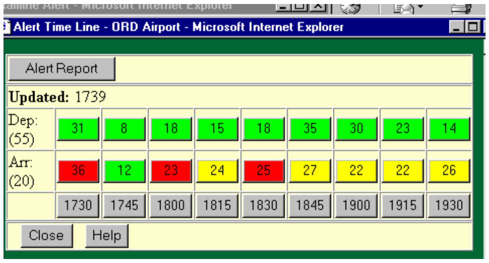

Exhibit 5-10. Sample MA Timeline Window

- FSM: to show airport arrival demand levels from the current time to several hours into the future (see example FSM demand bar chart below). If arrival demand is predicted to be excessive, the current traffic manager summarizes the results of any analysis performed and any TM initiatives being considered or in place to handle the situation.

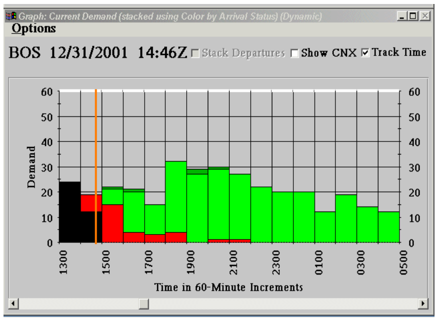

Exhibit 5-11. Sample FSM Arrival Demand Barchart

- DSP (where installed): to show the amount of traffic projected to cross each DSP departure fix in the next hour, the current traffic delay for any DSP airport or flight, and the airport departure lineup for any of the DSP airports.
- Radar-based display such as DSR, ACD, FDAD, or DBRITE: to point out real-time departure, en route, and/or arrival flow problem areas (e.g., flights on multiple routes that need to be merged into an arrival route). The type of radar display available is dependent upon the facility in which the TMU is located. DSR is available at ARTCC TMUs, ACD or FDAD is available at TRACON TMUs, and DBRITE is available at ATCT TMUs. The ATCSCC does not have a radar-based display.
- Status displays, whiteboards, and/or notes: to identify any special programs and /or TM initiatives in place that affect the current traffic demand.

Exhibit 5-12. TFM Tools for Determining Traffic Demand

TFM Tool	Description of How Tool is Used	Reference to Functional Audit Tool Description
TSD	The TSD is widely used within all FAA facilities to depict a large picture of the current traffic demand. It is often set up to show traffic across an extended region of the continental US (e.g., Eastern US, Western US, entire US) with filters and color-coding to depict the major traffic flows between major airports. Alternatively, multiple TSD windows are arranged on a single monitor to show flights arriving and departing from the major airports within the traffic manager's Area of Responsibility (AOR). The traffic manager looks at the volume of traffic departing from major airports that are destined for the traffic manager's AOR and applies professional experience to predict the volume of traffic expected to converge within his/her AOR over the next several hours.	6.1.23
MA	MA is often used in ARTCCs and is set up to permanently overlay the TSD. Yellow and red color-coding is used to indicate where demand is high based upon user-selected threshold values. MA was not used in any of the TRACONs that the TFM Functional Audit Team visited because ETMS is not set up to maintain flight counts for the terminal sectors and departure/arrival fixes in which the TRACONs are interested. TRACON traffic managers compensate for the lack of the MA timeline window by using either FCAs to mimic sectors (e.g., at SCT) or FSM airport demand bar charts (e.g., at N90).	6.1.15
Radar-based display • ARTCCs use DSR • TRACONs use ACD or FDAD • ATCTs use DBRITE	Tactical view of center traffic filtered according to traffic manager's need. Range ring overlays show spacing between aircraft. Used extensively to see the volume and spacing of aircraft. The radar display is the primary tactical display used by TMU traffic managers. It is preferable to TSD because of its more frequent update cycle. TSD updates flight positions once a minute whereas the radar-based displays update flight positions on the order of seconds. Note: The ATCSCC does not have a radar-based display.	6.4.3 (DSR) 6.4.1 (ACD) 6.4.5 (FDAD) N/A (DBRITE)
FSM	The demand chart for the airport can be set up to stack arrivals and departures to show relative contribution of each to the current demand situation. The traffic manager often displays multiple versions of FSM on a single monitor, one for each major airport within the traffic manager's AOR.	6.1.14
DSP (where installed)	DSP is used to evaluate demand and delays at DSP airports and departure fixes. The Flow Forecast Display indicates the number of aircraft projected to cross each DSP departure flow fix for the next one-hour period in 15-minute increments. It also provides information on any fix flow rate restrictions in effect. The Current Delay display provides current and historical ground delay information, in minutes, for any DSP airport or flight.	6.1.5
Status Displays • OIS • SAIDS • Homegrown tools	Status displays indicate conditions affecting traffic flow and demand. Status items include things such as TM initiatives, equipment outages, special events, runway configurations, etc. Not all facilities have a full complement of status displays. Handwritten notes often supplement the available status displays.	6.2.5 (OIS) 6.3.4 (SAIDS) 6.3.9 (TMC Tools) 6.3.12 (ZAU Restriction Manager)

After the position briefing occurs, the substitute traffic manager assumes position responsibility and continues to monitor the traffic demand situation using the tools mentioned above. Additional scheduled and non-scheduled briefings occur throughout the shift to alert the traffic manager of events that may affect traffic demand within the traffic manager's AOR. The traffic manager's supervisor provides briefings on any military and/or special event(s) planned for the day (e.g., VIP movement, NASCAR races) that affect air traffic demand in the TMU's AOR. Typically, special events have an associated NOTAM that summarizes the airports affected, the associated arrival/departure routes, and the time intervals during which heavy traffic can be expected (refer to Section 5.3.3 Plan for Special Civilian Events for further details). Military events also have associated NOTAMs and often cause specific airspace to become unavailable to commercial and general aviation traffic during the planned activity (refer to Section 5.5.2 Plan for Special Government Events for further details).

Collocated traffic managers or the traffic manager's supervisor may inform the traffic manager of changing conditions within the facility's AOR (e.g., weather, runway configuration) or an advisory may be printed on the FDIO printer informing all traffic managers of projected restrictions, reroutes, GDPs, etc. Any of these conditions may either increase or decrease the volume of traffic that is expected. For example, loss of a runway limits the number of departing and arriving traffic, and a reroute around weather may cause specific sectors to take on more traffic than normally handled.

Traffic managers also anticipate changes in the traffic demand based upon the decisions made during the SPT TELCON and documented in the current SPO (displayed on OIS and printed as an advisory on the FDIO printer). Traffic managers either dial-in to the regular SPT TELCONs conducted by the ATCSCC or their supervisor summarizes relevant information from the SPT TELCON. Relevant information includes projected restrictions, GDPs, reroutes, etc.

Traffic managers from the ATCSCC or adjacent facilities may call to indicate a changing traffic demand situation in their area(s) that has a backlash on the traffic manager's AOR. The changing traffic demand can be caused by increased/reduced traffic, degraded/improved weather, loss of or additional equipment, revised runway configurations, security breaches, etc.

Given the new information from the above sources, the traffic manager assesses the impact on traffic demand within his/her AOR. In order to do this, the traffic manager relies heavily on experience to project how traffic patterns depicted on the radar displays and TSD will change as a result of the anticipated change. For example, an imposed restriction places constraints on how closely flights can be merged onto a single route. The traffic manager must project into the future to determine if the anticipated traffic volume and flows can accommodate the new constraint without additional intervention. In some cases, analysis features built into the available tools are also used. For example, the Reroute feature on the TSD allows the traffic manager to display routes that may be used to avoid bad weather, and the FEA/FCA feature on the TSD allows the traffic manager to examine the flights predicted to penetrate areas of severe weather in order to determine how many flights are affected and their origins/destinations.

5.1.3.1.2 Airline Users

The primary goal of the airlines with respect to traffic management is to meet their flight schedules. The airlines would like the overall demand for limited air traffic control resources to accommodate their specific traffic demands. For this reason, airlines are interested in current and predicted flight demand as determined by the NAS. They use a variety of products to contribute to and determine NAS flight demand, including the following products.

- Homegrown flight schedule database tool(s): Each airline maintains a flight schedule database for the flight service it offers. Airlines use homegrown tools to manipulate the scheduled flights in their databases. American Airlines' tool is Flight Operations System (FOS) and Southwest Airlines' tool is Southwest Information Flight Tool (SWIFT).
- Flight Explorer: Flight Explorer is a vendor product licensed by some airlines (e.g., American Airlines and Southwest Airlines) to view current traffic demand. It is based on NAS data received by the vendor via the ETMS ASDI data stream (see Section 6.2.3 Aircraft Situational Display to Industry Data Feed). It is similar to the TSD.
- CCSD: CCSD is a recently deployed web-based product that the FAA provides to the airlines as a part of the CDM effort. It allows the airlines to view the same traffic demands and constraints as the FAA traffic managers. CCSD is similar to the TSD except that it does not display flight icons. Consequently, it does not compete with the ASDI vendor product line(s). CCSD provides the MA and FCA functions. Alerted resources (i.e., airports, fixes, sectors) and FCAs are displayed and the associated flight counts, flight lists, and individual flight details are available for browsing and printing. See Section 6.1.2 Common Constraint Situation Display for additional details.
- FSM: FSM is an FAA tool used for monitoring airport arrivals and departures. It is provided to the airline CDM community to enable them to share in the decision making process when traffic demand exceeds capacity. Airlines can view the airport demand charts and timelines, and can request reports and lists to analyze the available data.

5.1.3.2 ETMS-Based Displays

ETMS maintains current and predicted flight demand data. The current traffic demand data appears as aircraft icons on the TSD and WSD displays. Usually, it is filtered so that only traffic flows to/from selected airports, on specific routes, or over specific fixes are displayed. See Section 6.1.23.2.2 Flight Data for a more detailed discussion of how TSD/WSD displays flight data.

The ETMS MA function uses the predicted flight demand data. When predicted flight demands exceed a user specified threshold, the TSD/WSD/CCSD overlays are color coded to alert the traffic manager to the situation. Additionally, the MA function provides flight counts and reports pertaining to the alerted resource within the predicted timeframe to allow the traffic manager to analyze the specifics related to the traffic situation. See Section 6.1.23.2.3 Alerts for a more detailed discussion of alert processing and analysis functions.

FSM also uses current and predicted ETMS data for a specific airport. It obtains this data via the ADL interface and displays it on the FSM airport demand bar chart and its associated tabular timeline. See Section 6.1.14 Flight Schedule Monitor for a more detailed discussion of FSM.

5.1.3.2.1 ETMS Flight Data Processing

The CDM Hubsite, located at Volpe National Transportation Systems Center, has the overall task of integrating all available air traffic data and using it to predict future airport demand. It provides these predictions to the FAA and the airlines in an Aggregate Demand List (ADL), which is read by the Flight Schedule Monitor (FSM), and then used by CDM participants to monitor and analyze the data on future airport demand. The Command Center uses this data to implement ground delay programs.

The Volpe Hubsite houses the operational ETMS, the system responsible for receiving, processing, storing, and distributing flight data. It receives airline schedule data from the Official Airline Guide (OAG). The flight data is loaded into the live flight database fifteen hours before its scheduled departure. ETMS also receives NAS messages such as a flight plan (FZ), flight plan cancel (RZ), departure (DZ), position update (TZ), and arrival (AZ). The demand predictions are updated when any of these messages is received. In addition, ETMS receives real-time schedule updates from the airlines. These messages indicate when a flight is modified, canceled, or created. When these messages are received at the Volpe Hubsite, they are incorporated into the databases and used to produce the ADLs. The Command Center uses FSM and an ADL to define a ground delay program for an airport. It then sends that program to the Volpe Hubsite and the program is included in subsequent ADLs for that airport.

Refer to Section 5.3.1 Maintain Operational Data for additional details on TFM flight data acquisition, distribution, archival, and restoration.

5.1.3.2.2 ETMS Flight Modeling and Demand Prediction

ETMS requires flight paths, ground speeds, and altitudes for scheduled flights to estimate the impact that the flight will have on the NAS. This information is found in Field 10 of a filed flight plan but not in the flight schedule data. A filed flight plan usually enters the NAS about one hour prior to departure when it is submitted by the airline. Since ETMS predicts traffic demand using flight schedule data long before a flight plan is filed (i.e., up to 15 hours in advance of the current time), it makes a best guess to determine the needed information. For this purpose, ETMS maintains a historical database of flight paths, cruising speeds, and cruising altitudes observed in recent flight plans. As ETMS adds a scheduled flight into the live database, it uses the most commonly filed flight path, speed, and altitude for the flight's city pair, airline, and/or aircraft type. The *ETMS 7.4 Functional Description, Appendix A, Determination of Flight Plan Data for Scheduled Flights* contains a full description of how ETMS determines flight plan data for scheduled flights. When the filed flight plan is received and/or updated, ETMS replaces the estimated flight routing information with the information from the filed flight plan. The *ETMS 7.4 Functional Description, Section 6 Field 10 Processing* describes how ETMS processes the Field 10 information.

After the flight path of a scheduled flight is determined, ETMS continues to model the flight using three steps: determining the altitude and speed profile of the flight (i.e., what altitude and speed the flight will have at any point along its flight path); determining the flight events; and computing the event times. The flight events are airport arrivals and departures, sector entries and exits, ARTCC entries and exits, airway entries and exits, and fix crossings. Each flight event is defined as the event type, the position in latitude and longitude, the speed and altitude of the aircraft at the event, and the time of the event. Both aircraft characteristics and wind data are used during flight modeling. The *ETMS 7.4 Functional Description, Section 7 Flight Modeling* describes how ETMS determines the flight profile, generates flight events, and computes flight event times.

The results of ETMS flight modeling support the following: TSD flight display, MA processing, and FSM demand charts and timelines.

5.1.4 Monitor for Demand/Capacity Imbalance

This subsection describes the processes, tools and data used at both national and local traffic management facilities to compare capacity and demand data to determine if there are probable imbalances, isolate the areas where problems are most likely, maintain a common situational awareness, and monitor for predicted and non-predicted problems. In addition, this subsection touches on situation monitoring capabilities provided to the wider aviation community.

5.1.4.1 Approaches

All TMUs are continually monitoring NAS resources to determine if there is an imbalance between capacities and demand. The approach and focus vary depending on the facility (i.e., ATCSCC, ARTCC, TRACON or ATCT) and its nominal planning horizon. The subsections below summarize the planning horizon and the monitoring approach for each type of facility.

5.1.4.1.1 ATCSCC Planning Horizon and Approach

The ATCSCC has a national, strategic outlook and has the longest planning horizon among all of the facilities, up to 6 hours into the future. This long outlook is designed to prevent, or minimize the impact of, imbalances in one area of the country from having a ripple effect on the others. Specific attention is paid to pacing airports and the major routes between them. Pacing airports are those airports that have a consistently high volume of arrival and departure traffic to and from other major airports across the country.

Much of the ATCSCC strategic attention is focused on the national weather picture and the impact that it has on resource capacity, particularly for predicted severe weather. With respect to weather, the goal of the ATCSCC is to *prevent* demand/capacity imbalances. The ATCSCC elements that are in place to achieve this goal are the Weather Unit, the Severe Weather Unit whose focus is on reroutes around bad weather, and the SPT/SPO. The SPT TELCON involves traffic managers from all affected facilities and participating CDM airlines. All participants in the SPT TELCON have access to the same FSM and route data as the SPT.

The ATCSCC also has a more tactical focus that detects and handles more immediate demand/capacity imbalances. The East and West Area Specialists work with the field site TMUs to minimize the impact of current and projected (i.e., within two hours or less) demand/capacity imbalances. FSM, TSD, and DSP (in the East Area) are used to directly determine, often graphically, current and predicted demand/capacity imbalances. The ATCSCC TMS uses information from weather displays and the OIS Summary Display to determine areas that warrant special attention due to pending/current bad weather, equipment outages, special activities, or non-optimal runway configurations. The TMS also relies on verbal communication from the field TMUs for periodic updates on their demand/capacity situation and the status of the elements that affect them.

5.1.4.1.2 ARTCC and TRACON Planning Horizon and Approach

ARTCCs and TRACONs are concerned with center/terminal arrivals, departures and overflights. Generally, flights are in and out of ARTCC/TRACON boundaries in an hour or less, and this is the interval over which TMCs wish traffic to flow freely. Although the TSD and FSM tools are set up to monitor demand/capacity many hours into the future, ARTCC/TRACON TMCs do not get concerned until the imbalance is predicted to be within a two-hour window. TMCs have found that the number of uncertainties related to airline schedules and delays, weather, and ETMS flight modeling often cause flight demand predictions beyond two-hours to be inaccurate or likely to change. When a demand/capacity imbalance is predicted to be within two-hours into the future, there is reasonable assurance that the prediction is accurate and it is time to plan and implement an initiative to align demand with capacity.

Like the specialists at the ATCSCC, ARTCC and TRACON TMCs use TSD, FSM, and DSP (where installed) to graphically determine current and predicted imbalances. ARTCC TMCs also use MA to determine current and predicted imbalances. ARTCC and TRACON TMCs focus their attention on the major airports in their areas and the major routes into which traffic must be merged. They also use weather displays, upcoming special civilian/military activities, and equipment and runway status information, to direct their attention to areas where demand is more probable to exceed capacity.

5.1.4.1.3 ATCT Planning Horizon and Approach

Traffic management at an ATCT is extremely tactical. Traffic specialists are more concerned with getting flights that they can see on and off of the ground rather than with predicting future demand/capacity imbalances. Only eight towers have TM tools installed; the majority of towers do not. In general, towers depend on their overlying TRACON/ARTCC to monitor and control the airport demand/capacity balance. Towers that have TSD/WSD installed have the MA function available for monitoring current and predicted demand/capacity at their airport. They can also see the flow of traffic destined to arrive at their airport. Some towers (i.e., 7 busy New York airports) have DSP installed. These towers can view lists of all departing flights that are proposed, cleared, taxiing, in final lineup, or held at the gate. Because the proposed flight information is obtained from the HCS and the HCS receives proposed flight data approximately one hour prior to scheduled departure, the longest interval that these lists cover is approximately one hour. This is the demand available to the ATCT traffic manager.

The ATCT traffic manager is responsible for recommending the airport capacity to the ATCSCC when it is affected by real-time events such as runway icing, a fuel spill, or an air traffic incident. When one of these events occurs, the airport demand and capacity are almost always immediately out of balance. This information is relayed verbally to the overlying ARTCC/TRACON TMU, and to the ATCSCC where local advisories are distributed and information status displays (e.g., OIS) are updated.

The TFM Functional Audit Team did not visit any towers.

5.1.4.2 Tools for Monitoring Demand and Capacity Balance

Traffic managers use the following tools for monitoring demand and capacity: TSD / WSD, MA, and FSM. All of these tools are based on ETMS data residing at the ETMS Hubsite. This permits all traffic managers, no matter where they are located, to share and view the same demand and capacity information at any given point of time. Refer to Section 5.1.3.1.1 FAA Service Providers for a summary of how these tools are used. In addition to what is described there, note that capacities and / or Monitor Alert Parameters for each of the monitored resources in FSM (i.e., airports) and MA (i.e., airport, fixes, and sectors) are provided along with traffic demand counts on the bar charts and list reports available from the TSD, MA, and FSM.

5.1.4.3 Airlines and Common Situation Monitoring

The airlines have a vested interest in how flight demand and resource capacity problems are resolved. As a part of the CDM effort, the FAA has made the CCSD (a web-based, TSD-like application) and FSM available to the CDM participating airlines so that they can see and analyze the same data that is available to FAA traffic managers. Additionally, some airlines rely on ASDI-based vendor products, such as Flight Explorer, to provide a picture of NAS capacity and demand. Refer to Section 5.1.3.1.2 Airline Users for a summary of these tools.

5.2 TM Initiative Planning and Implementation

This section discusses the types of Traffic Management Initiatives (TMIs) currently employed (and under what conditions), and provides insight into systems that contribute to an understanding of what the impacts of each type of TMI proposed will be, especially when multiple TMIs are imposed.

Throughout the day, traffic managers maintain situational awareness, monitoring areas where imbalances have a high probability of occurring, and communicating regularly with other specialists, facilities, and resources to enhance and refine the big picture. The purpose of these activities is to identify an emerging problem early, in order to be able to quickly assess and initiate the least drastic measures possible to ensure air traffic across the NAS is as safe and efficient as practicable. As demand increases and/or capacity decreases, the probability of an imbalance with more severe impacts on flow management increases. The traffic manager begins to mentally form a plan to address the potential problem he or she is monitoring should the scope of impacts spread or become more serious. Even before it becomes obvious that there is a real issue, the traffic manager usually has a good idea of what he/she will try first to mitigate a problem should it materialize or deepen. Refer to the Section 5 introduction for a list of the TM Initiatives most often employed, ranked in order of least to most restrictive. The choice of initiative(s) made by traffic managers is predicated on resolving any situation with the least restrictive method possible, usually beginning, if possible, with a strategy to contain the problem at the local level as much as possible.

Armed with continually updated environmental information, a wealth of previous experience and ongoing input from users as well as other affected facilities, if any, the traffic manager or team of specialists discuss and test alternatives until they feel they have the appropriate initiative to try first. They also discuss the need for a backup or follow-on plan and how that would be implemented. For instance, if a ground stop is imposed, the impact may be a high demand for departures after the ground stop is cancelled which, in turn, may require the imposition of a GDP. The testing and further validation of an initiative strategy is done using TFM tools discussed in this section. All of these planning and validation activities are documented for later review. After a TM initiative choice is made and implemented, constant monitoring of the situation is undertaken to ensure that any adjustments required are made in a timely manner.

Each flow issue or potential issue, once it has been identified, is subject to the following general process.

- Determine whether to implement an initiative to deal with congestion or other flow issue.
- Determine which initiative is the optimum solution to the particular flow problem.
- Validate the initiative selection.
- Implement the initiative by disseminating TM plans to all affected users/stakeholders.

- Monitor the results of the initiative to ensure it is effective and does not negatively impact other operations/initiatives.
- Make adjustments or changes as necessary, i.e. adjust the solution, or implement another solution as required when a situation changes.
- Terminate the initiative and accommodate impacts resulting from the initiative.

This section breaks down the discussion of the primary TM initiative strategies into the following subsections:

- Section 5.2.1, Assess and Implement Restriction Strategies
- Section 5.2.2, Assess and Implement Metering Strategies
- Section 5.2.3, Assess and Implement Rerouting Strategies
- Section 5.2.4, Assess and Implement Other Airborne Delay Strategies
- Section 5.2.5, Assess and Implement Ground Delay Strategies.

5.2.1 Assess and Implement Restriction Strategies

This subsection describes the processes, tools, and data used at both national and local traffic management facilities to manage air traffic using the TM restriction process. Because the TM restriction process has the same phases and follows the same ground rules as all other TM initiatives, only the portions of the process that are unique to restriction initiatives are presented. The remainder of this subsection discusses restriction types, alternatives, decision-making, approval, implementation, monitoring, adjustment, and cancellation.

5.2.1.1 Restriction Types

Restrictions exist in the several forms that are listed below. No matter the form, each restriction has an associated time interval over which it is valid.

- Miles-in-Trail (MIT)/Minutes-in-Trail (MINIT) – Imposes a minimum separation between aircraft using either distance or time as the separation factor. MIT is used most often in US domestic airspace while MINIT is used most often in oceanic airspace.
- Approval Request (APREQ)/Call for Release (CFR) – Often used to supplement an MIT restriction within an ARTCC or TRACON. Requires a tower to contact the overlying TRACON or ARTCC for a release time for each departing flight that enters the TRACON/ARTCC airspace. The APREQ/CFR process merges departing flights into a fairly saturated en route traffic stream by using a gap in the aircraft stream.

  After the TRACON/ARTCC notifies the tower(s) that an APREQ is in effect, the tower contacts the TRACON/ARTCC with a verbal CFR suggesting a departure time for a flight. The TRACON/ARTCC TMC looks for a gap in the en route stream near the suggested departure time and mentally calculates a time by which the flight must depart to fill in the gap. This time plus a small window of time on either side of it is given to the tower TMC as the release time. The TRACON/ARTCC is the final authority for issuing an APREQ. No additional approval is necessary.

  The Chicago Center (ZAU) refers to the APREQ process under a different name, ESP (Enroute Spacing); however, the processes are identical.
- Altitude – Restricts flights to specific altitude levels. May be used to avoid severe weather en route.
- Speed Control – Restricts flights to a specific speed

Only MIT and APREQ/CFR were observed in use during the TFM functional audit team site visits to Washington and Chicago Centers, Southern California and New York TRACONs, and the ATCSCC. Both were used extensively.

5.2.1.2 Restriction Alternatives

Restrictions, like all other TM initiatives are implemented when demand for a resource (i.e., airport, fix, sector, or center) exceeds its current capacity. Restrictions are often preferable to other types of TM initiatives because of their limited impact on airline schedules, fuel consumption, and passenger good will. Additionally, a local restriction (i.e., one whose impact remains local to the facility in which it is implemented) is preferable to an external restriction (e.g., MIT over a center boundary) that has impact on other facilities and/or national traffic flows. External restrictions require higher-level approval. Exhibit 5-13. External Restriction Alternatives summarizes the alternatives that are preferable to external restrictions and those that are not. Generally, the preferable alternatives are local initiatives that do not impact traffic outside of the initiating facility. The non-preferable alternatives tend to affect traffic on a national basis, disrupt airline schedules, and/or upset passengers. They are exercised in situations where an external restriction is ineffective in balancing air traffic demand with capacity.

Exhibit 5-13. External Restriction Alternatives

Preferable Alternatives to External Restriction	Non-Preferable Alternatives to External Restriction
• Balance departures and arrivals at airport to reduce or eliminate departure and/or arrival delays. Considered a local restriction that does not require higher-level approval. Implemented as a departure MIT. • Fix Balancing – distribute local arrival and departure traffic over the available arrival and departure fixes, respectively. Implemented as a local route change. – Offload a fix that will have delays – Divert from a sector that is congested • Sequence and space departures (i.e, metering solutions) – this option is a variation of MIT/MINIT that assigns a sequencing order to flights passing over a departure fix	• Airborne holding • GDP – usually used for handling en route problems related to severe weather • Ground Stops due to weather, accident, or other emergency situation

5.2.1.3 Restriction Decision Making

Restrictions originate in the TRACON or ARTCC as a means of limiting demand over a specific fix or airspace. The excess demand that causes a restriction to be considered include the following:

- Scheduled demand exceeds capacity for a specific time period
- Lack of en route stream gaps for departures
- Arrival traffic utilizes the same runway as departure traffic
- Runway configuration or capacity change is dictated by weather (e.g., visibility, winds)

- External restriction is imposed on a facility (i.e., restrictions from another ARTCC such as creating an MIT restriction at the boundary) that has a heavy volume of converging traffic
- Demand does not exceed airport capacity, but demand for an airport resource (e.g., fix) exceeds its capacity.

Because the air traffic environment is so complex and dynamic, ARTCC and TRACON traffic managers do not have a cookbook method of deciding what restrictions to apply under what circumstances. Instead the TMCs rely on their experience, the TFM tools at hand, and information exchange across facilities to determine the least restrictive course of action needed to mitigate a demand problem. Although there are no prescribed restrictions to specific air traffic demand problems, the TFM functional audit team did observe, during their site visits, some common approaches to applying restrictions to typical demand problems. Typical problems with one or more common approaches for applying restrictions include the following:

- Arrival Capacity Exceeded
- Departure Capacity Exceeded
- En Route Sector Capacity Exceeded
- Imposed MIT Can't Be Met.

Each of these typical problems is discussed below. For each type of problem, one or more common restriction approaches and the supporting TFM tools are summarized. Refer to Exhibit 5-14. Restriction Setting: Supporting TFM Tools and Interactions to illustrate the interfacility interactions and the tools used to support the restriction setting process.

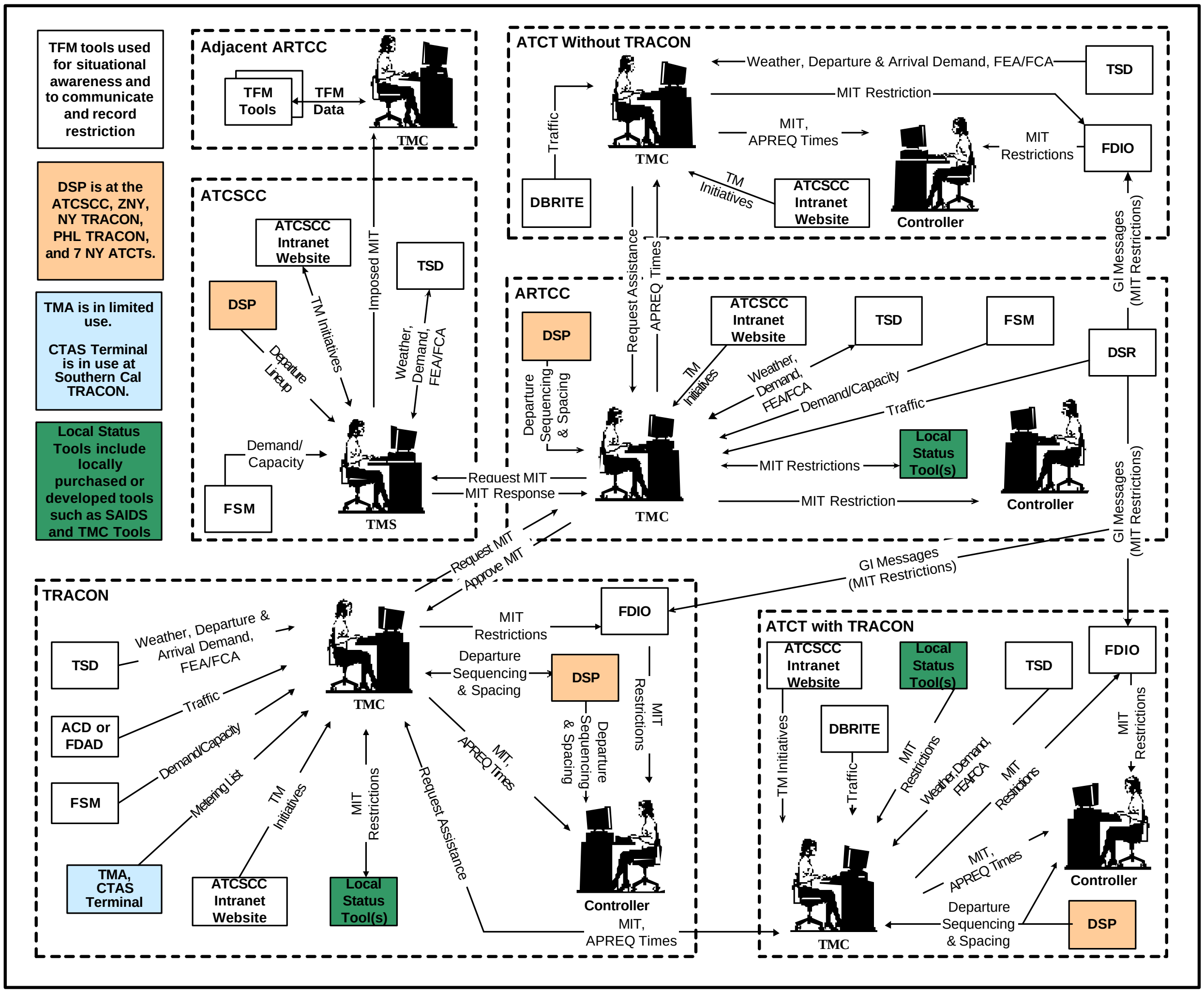

Exhibit 5-14. Restriction Setting: Supporting TFM Tools and Interactions

5.2.1.3.1 Arrival Capacity Exceeded

The TRACON/ARTCC TMC responsible for arrival management handles both actual and predicted arrival demand problems. The ATCT may contact the overlying TRACON/ARTCC TMC for help in eliminating existing arrival delays. Alternatively, the TRACON/ARTCC TMC may detect an actual or predicted arrival delay by monitoring the FSM arrival demand chart.

Analysis Performed

The TRACON/ARTCC TMC uses the tools summarized in Exhibit 5-15. Tools for Determining Restrictions to Resolve Arrival Demand Problems to determine if some type of restriction will resolve the arrival demand problem.

Exhibit 5-15. Tools for Determining Restrictions to Resolve Arrival Demand Problems

TFM Tool	Description of How Tool is Used	Reference to Functional Audit Tool Description
TSD	Regional view provides the big picture of how much traffic is headed for the airport. Helps TMC decide if arrival problem is expected to continue or is short term.	6.1.23
DSR (if ARTCC) or ACD/FDAD (if TRACON)	Tactical view of center is filtered to show arrival flows. Range ring overlays show spacing between aircraft. Used extensively to anticipate where separation will not be achieved if nothing is done. Also used to identify gaps into which arriving flights can be slipped.	6.4.3 (DSR) 6.4.1 (ACD) 6.4.5 (FDAD)
FSM	The demand chart for the airport can be set up to stack arrivals and departures to show relative contribution of each to the current demand problem. The arrival demand chart shows the interval of time where arrival capacity is exceeded. The TMC may generate an arrival report for that interval to assist in analysis efforts and to determine the time bounds for the potential restriction.	6.1.14
DSP (if available)	Computes new airport departure lineup and times based upon the input airport departure rate	6.1.5
TMA or CTAS Terminal (if available)	Arrival lineups show gaps into which arriving flights can be slipped. Computes new airport arrival lineup based upon the input airport arrival rate	6.4.9 (TMA) 6.3.5 (CTAS Terminal)

Option A: If the available information indicates the arrival demand heavily outweighs departure demand, the TMC considers reducing the departure rate so that arrivals can be handled more quickly. If experience indicates the average departure delay and the number of affected flights resulting from the departure rate reduction is acceptable, the TMC may issue a departure MIT or increase the current departure MIT. Conversely, the arrival rate is increased. By increasing the MIT between successive departures the departure rate is reduced. Higher-level approval is not required for this restriction.

Note: NY Center (ZNY) and TRACON (N90) alter the departure rate through DSP (see Section 5.2.2 Assess and Implement Metering Strategies) and do not impose a departure MIT. Higher-level approval is not required.

Option B: If the available information indicates the arrival demand is about the same or less than the departure demand and the problem extends over multiple 15-minute intervals, and/or most of the arrival demand is coming over one or more boundary fix(es), the TMC may request an MIT restriction over the boundary fix(es). Higher-level approval is required since at least one other center is affected.

This option is in use at N90 where it is exercised as follows. The TMC generates the FSM arrival report when the FSM demand chart indicates that capacity is expected to exceed demand in the near-term future (i.e., approximately 2 hours beyond the current time). The arrival report breaks down arrival counts into 15-minute intervals by arrival fix, where each arrival fix is associated with a specific external center. The TMC analyzes the report to find out which arrival fix(es) contribute most to the arrival demand and what time interval is involved. The

TMC checks the demand chart approximately one hour before the problem interval begins. If the arrival demand is still projected to exceed the arrival capacity, the TMC may request an MIT for flights using the problem arrival fix(es).

Option C: If experience indicates MIT restrictions cannot handle the combined arrival/departure demand, the TMC may consider another alternative such as airborne holding (see Section 5.2.4) or may request a GDP (see Section 5.2.5).

5.2.1.3.2 Departure Capacity Exceeded

The TRACON/ARTCC TMC responsible for departure management handles both actual and predicted departure demand problems. The ATCT may contact the overlying TRACON/ARTCC TMC for help in eliminating existing departure delays. Alternatively, the TRACON/ARTCC TMC may detect an actual or predicted departure delay by monitoring the FSM departure demand chart. This situation most often occurs after a ground stop has been terminated.

Analysis Performed

The TRACON/ARTCC TMC uses the tools summarized in Exhibit 5-16. Tools for Determining Restrictions to Resolve Departure Demand Problems to determine if some type of restriction will resolve the departure demand problem.

Option A: If the available information indicates the departure demand heavily outweighs arrival demand, the TMC considers reducing the arrival rate so that departures can be handled more quickly. If experience indicates the average arrival delay and the number of affected flights resulting from the arrival rate reduction is acceptable, the TMC may issue an arrival MIT or increase the current arrival MIT. Conversely, the departure rate is increased. By increasing the MIT between successive arrivals the arrival rate is reduced. Higher-level approval is not required for this restriction.

Note: Centers and TRACONs with TMA installed alter the arrival rate through TMA (see Section 5.2.2 Assess and Implement Metering Strategies) and do not impose a departure MIT. Higher-level approval is not required.

Exhibit 5-16. Tools for Determining Restrictions to Resolve Departure Demand Problems

TFM Tool	Description of How Tool is Used	Reference to Functional Audit Tool Description
TSD	Regional view provides the big picture of how much traffic is headed into and out of the airport. Helps TMC decide if departure problem is expected to continue or is short term.	6.1.23
DSR (if ARTCC) or ACD/FDAD (if TRACON)	Tactical view of center is filtered to show departures and overflights. Range ring overlays show spacing between aircraft. Used extensively to anticipate if overflight traffic can accommodate additional departures and to identify gaps into which departing aircraft can be slipped.	6.4.3 (DSR) 6.4.1 (ACD) 6.4.5 (FDAD)
FSM	The demand chart for the airport can be set up to stack arrivals and departures to show relative contribution of each to the current demand problem. It also helps the TMC determine the time bounds for the potential restriction.	6.1.14
DSP (if available)	Computes new airport departure lineup and times based upon the input airport departure rate	6.1.5
TMA or CTAS Terminal (if available)	Computes new airport arrival lineup and times based upon the input airport arrival rate.	6.4.9 (TMA) 6.3.5 (CTAS Terminal)

Option B: If the available information indicates the departure demand is about the same or less than the arrival demand and the problem extends over multiple 15-minute intervals, and/or most of the overflight demand is coming over one or more boundary fix(es), the TMC may request an MIT restriction over the boundary fix(es). Higher-level approval is required since at least one other center is affected.

Option C: If experience indicates MIT restrictions cannot handle the combined arrival/departure demand, the TMC may consider another alternative such as airborne holding (see Section 5.2.4) or may request a GDP (see Section 5.2.5).

5.2.1.3.3 En Route Sector Capacity Exceeded

The ARTCC TMC detects actual and predicted sector capacity problems by monitoring the TSD and MA functions. Both functions typically run on the same workstation with the MA window overlaid on the TSD. Both functions provide a visual cue when the sector capacity is exceeded or predicted to be exceeded.

Analysis Performed

The ARTCC TMC uses the tools summarized in Exhibit 5-17. Tools for Determining Restrictions to Resolve Sector Demand Problems to determine if some type of restriction will resolve the sector demand problem.

Exhibit 5-17. Tools for Determining Restrictions to Resolve Sector Demand Problems

TFM Tool	Description of How Tool is Used	Reference to Functional Audit Tool Description
TSD	The TSD is set up to provide sector alerts if capacity is predicted to exceed demand during the upcoming user selected time period. The time period may be specified in quarter hour increments from 0.25 to 2.25 hours. Alerted sectors are graphically depicted with red or yellow hatching within the sector boundaries. Red indicates that the alert is being generated for airborne flights. Yellow indicates that the alert is being generated for airborne and pending flights that are predicted to reach the sector at the same time.	6.1.23
MA	Provides peak counts for the alerted sector within each 15-minute interval and enables the traffic manager to generate analysis reports/lists.	6.1.15

Option A: If extra demand is caused by normally heavy, scheduled traffic (e.g., in the Northeast Corridor), the TMC may request an MIT known to handle the traffic volume. The MIT restriction needs higher-level approval.

Option B: If extra demand is caused by an active TM initiative that diverts traffic around severe weather, the TMC may request an increased MIT. The MIT restriction needs higher-level approval. Note that this situation is usually anticipated by the SPT at the Command Center during the planning of severe weather reroutes and is typically discussed during the regularly scheduled TELCON hours before the reroutes occur.

5.2.1.3.4 Imposed MIT Can't be Met

Sometimes a center cannot meet an MIT restriction imposed on traffic leaving its center over a specific fix. This situation may occur when traffic along multiple, heavily traveled routes within the center converges at or before the restricted fix. The ARTCC TMC handles this problem.

Analysis Performed

The ARTCC TMC uses the tools summarized in Exhibit 5-18. TFM Tools for Determining Restrictions to Resolve MIT Problem to determine if some type of restriction will resolve the MIT problem.

Exhibit 5-18. TFM Tools for Determining Restrictions to Resolve MIT Problem

TFM Tool	Description of How Tool is Used	Reference to Functional Audit Tool Description
TSD	Regional view provides the big picture of how much traffic is headed in and out of the center. Flights are color coded to depict their final destination. Helps the TMC to determine if the problem is ongoing or short-lived.	6.1.23
DSR	Tactical view of center is filtered to show departures and overflights. Range ring overlays show spacing between aircraft. Used extensively to anticipate if overflight and departure traffic can be merged into the stream of traffic headed towards the restricted fix without violating the MIT restriction.	6.4.3
DSP (if available)	Computes new airport departure lineup and times based upon the input airport departure rate	6.1.5

The restriction options summarized below can be implemented alone or in combination with one another.

Option A: If the traffic contributing to the problem is being fed to the center by an adjacent center with a high volume of traffic headed to the restricted fix and the high volume is expected to continue, the TMC is most likely to request an MIT restriction on the adjacent center at the boundary fix between them. When this situation occurs, the requested MIT restriction is referred to as a *passback* restriction. The *passback* MIT restriction is larger than the MIT restriction that can't be met. This allows other traffic to be merged into the flight stream. The ATCSCC must approve the restriction.

For example, if Cleveland Center (ZOB) can't meet its 20 MIT restriction for JFK bound flights because it is expecting the high volume stream of JFK bound traffic from Chicago Center (ZAU) to continue, it may request to *passback* a 25 MIT restriction to JFK bound flights from ZAU. This situation is a common occurrence between ZOB and ZAU except that the size of the MIT restriction varies.

Option B: If the traffic contributing to the problem is being fed to the center by an underlying TRACON or ATCT with a regular (i.e., consistent) volume of traffic headed to the restricted fix, the TMC may decide to issue a departure MIT to the underlying facility. Higher-level approval is not required for this restriction.

Note: If the New York TRACON (N90) is the recipient of a departure MIT restriction, it converts the MIT value to a departure rate value (e.g., a 20 MIT rate converts to a departure rate of 12) and uses DSP to manage the departure times and sequence for the underlying towers that use DSP. A handwritten MIT/departure rate conversion chart is taped to the side of the work area where the DSP workstation resides. For the underlying ATCTs that do not have DSP installed, N90 issues an APREQ for the time period covered by the departure MIT restriction.

Option C: If the traffic contributing to the problem is being fed to the center by an underlying TRACON or ATCT with an irregular (i.e., inconsistent) volume of traffic headed to the restricted fix, the TMC may decide to issue an APREQ to the underlying facility. This will allow the ARTCC TMC to look for a gap in the en route stream into which the departing flight can fit.

Option D: If the imposed MIT can usually be met but not for specific, isolated flights, the TMC works with the Area Supervisors on the control room floor. Controllers may speed up front runners and incrementally slow down the rest, or may vector a problem aircraft to buy time and/or space. If the problem still cannot be resolved, the TMC may contact the TMC in the adjacent center (i.e., the one that imposed the restriction) and ask for relief from the restriction. If none is granted, handoff between the centers will not occur and the center that failed to meet the restriction will be forced to *spin* (i.e., hold) the aircraft at the center boundary.

5.2.1.4 Restriction Approval Process

The restriction approval process is much like the approval process for all other TM initiatives. If the restriction only impacts the underlying facilities, it is considered local and no higher level approval is required. However, if the restriction has impact on facilities outside of the TRACON or ARTCC that issued the restriction, it needs to be approved at a higher level. The higher-level authority validates the need for the restriction and contacts the affected parties to determine the impact.

The ATCSCC determines the validity of the restriction by viewing the FSM demand/capacity airport chart, the TSD for the region, and the weather situation. The ATCSCC TMS also determines if other ARTCCs can handle the restriction by including them in a conference call and asking for their assessment. If the restriction will impact one or more carriers much more than the others, the ATCSCC TMS may also contact the airline(s) for an assessment. Carrier impact is determined through experience, by asking the ARTCC TMC, or by viewing the FSM demand chart by carrier. If the proposed restriction is caused by en route congestion that is expected to be significant in duration and severity, the ATCSCC TMS may choose to implement a GDP rather than approve the restriction.

If the impact is acceptable, the restriction is approved. If not, the traffic managers work together to determine an acceptable alternative. Refer to Exhibit 5-14. Restriction Setting: Supporting TFM Tools and Interactions for a depiction of the interfacility communication interfaces.

The approving authority logs the restriction into the position log, as does the TMC in each of the affected facilities. If the approving authority uses TMLog, the restriction has already been entered by the requesting TMC and the approver merely needs to accept the restriction. As of August 2002, only a few centers and one position at the ATCSCC use TMLog. All traffic managers at the remaining facilities and Command Center positions use either ETMS Log or a locally developed log such as ZAU TMU Log or the Blue Log. Traffic managers at the remote sites may also need to log the restriction into one or more locally developed/procured status information tools (e.g., SAIDS).

Once a restriction is approved it is distributed to all of the affected facilities as follows.

- If a restriction affects only TRACON airspace (e.g., some departure MIT restrictions), the TRACON provides the restriction to the underlying ATCTs and informs its parent ARTCC.

- If a restriction affects only the ARTCC airspace, the ARTCC informs its underlying TRACONs and ATCTs of the restriction and informs the ATCSCC. The underlying TRACONs send the restriction to their underlying ATCTs or issues APREQs to them as needed.
- If a requesting ARTCC receives ATCSCC approval for a restriction and the restriction is imposed on an adjoining ARTCC, the affected ARTCCs inform their underlying TRACONs and ATCTs of the restriction. The underlying TRACONs send the restriction to their underlying ATCTs or issues APREQs to them as needed.

5.2.1.5 Implement, Monitor, and Adjust Restriction

After a restriction is approved/imposed and distributed to the TMCs, the TMCs pass the restriction on to the ATC controllers for implementation. The TMCs begin to monitor the most recent restriction along with other active restrictions. It is not unusual for multiple restrictions to be active at the same time.

The TMC uses various techniques for remaining aware of the active restrictions depending upon the facility procedures in place. Some TMCs maintain a handwritten list of restrictions and times while others refer to automated displays that are conveniently placed for viewing.

TRACON and ARTCC TMCs monitor the TSD as well as the DSR or ARTS displays to look for problem areas, verify that controllers in the local facility and the adjacent centers are meeting the restriction, and verify that the restriction is having its desired effect.

- If a restriction is not being met, the TMC communicates verbally with the appropriate TMC or area supervisor to resolve the problem. If the problem still cannot be resolved, the problem is escalated to the Command Center and other tactical solutions such as airborne holding may be imposed.
- If the restriction is not having the desired effect, the restriction may be increased or augmented (e.g., APREQ restrictions may be added to the current MIT restriction, the current MIT restriction may be increased).
- If the restriction is having its desired effect but the demand problem continues beyond the expiration time of the restriction, the restriction end time is extended.
- If a restriction to resolve an arrival/departure delay is not having the desired effect and the TMC can’t resolve the problem via fix balancing, arrival/departure balancing, vectoring, or speed maneuvering, the problem is escalated to the next higher authority for resolution.
- If the restriction is being met and the desired effect has been achieved, the restriction may be cancelled if its expiration time is not imminent.

All modified and extended restrictions go through the same approval and distribution process as the original restriction.

5.2.1.6 Cancel Restriction

Restrictions expire at the end of the time interval associated with them. Each affected TMC has his/her own way of remembering when the restriction is expired. This often involves notes jotted down on a piece of paper.

Restrictions can be cancelled before they expire in the following manner:

- If a demand problem ends before the restriction expires, the facility that issued/requested the restriction cancels the restriction by contacting all of the affected facilities.
- If a demand problem becomes significant in duration and severity, the ATCSCC may choose to replace it with a more restrictive TM initiative such as a GDP. This action is usually analyzed by the SPT and discussed during the SPT TELCONs. The ATCSCC informs all affected facilities verbally or through an electronic advisory.

When a restriction is cancelled, the traffic managers at the ATCSCC and all affected facilities log the cancellation in their facility log and remove the restriction from any of the status information systems installed in their facility.

5.2.2 Assess and Implement Metering Strategies

This subsection describes the processes, tools and data used at local traffic management facilities to decide on, and use, metering as a strategy (during the departure, enroute or arrival phases) to address a current or predicted imbalance.

Metering is defined here as managing the time of arrival of a flight or flights at a predetermined fix or intersection, or route merge point, in such a manner as to maintain separation (at or above standard intervals depending on the situation), and to balance or increase flows which affect more than a single sector. For the purposes of this document and in the vernacular, the words metering, sequencing and spacing may be used synonymously, however, in reality there are subtle differences. Sequencing may involve both spacing between flights, and the integration of one or more flights into an already existing stream of aircraft along a departure, arrival or enroute corridor/route. Spacing involves ensuring adequate separation between aircraft while being integrated and/or while in the stream.

Metering is a dynamic initiative imposed on an as-needed basis to manage fluctuations in traffic demands. Since metering is considered a tactical strategy it is not normally directed by the ATCSCC, although the ATCSCC is often informed, especially if delays of more than 15 minutes are incurred, and/or there are impacts on adjacent facilities.

Metering may be chosen as a technique to space departures from a number of airports passing over only a few departure fixes in a congested airspace such as the Northeast corridor, manage the merging and flow of traffic when there are a limited number of routes around severe weather, or to combine arrival flows to a busy airport over one or more arrival fixes.

Metering tools and procedures provide decision support for specialists attempting to fit additional flights into an often saturated route. At some facilities, metering is executed procedurally. The tools used are limited to standard flight displays (TSD and radar), and the specialist must apply his/her knowledge and experience to find or make the 'holes' to fit flights into a crowded departure route or approach. At other facilities, more automation is available and used for decision support. The primary tools available to TMCs to determine whether metering should be used and to execute a metering strategy are one or more of the following:

- Radar derived positional information displayed on Display System Replacement (DSR), Full Digital ARTS Display (FDAD), or Airport Situation Display (ASD), which provides real time integrated but somewhat limited radar information from all ATC facilities.
- ETMS TSD flight display information to give a general overview of traffic flow patterns in slightly less than real time, as well as indications of fix and route loading.
- ETMS Monitor Alert to alert specialists of a potential or real imbalance at a particular NAS element.
- HCS En Route Spacing Program (ESP)/Arrival Sequencing Program (ASP) which require a significant amount of heuristics and guess work on the part of the TMC to predict the current and future demand. For this reason, use of these tools requires

extensive procedures or has been discontinued and replaced by other tools such as Traffic Management Advisor (TMA) and Departure Spacing Program (DSP).

- DSP for sequencing departures in complex congested airspaces surrounding northeast corridor.
- At some facilities, TMA is also in use for arrival sequencing. See Exhibit 5-19. Facility Use of Metering Tools.
- User Request Evaluation Tool (URET) may also be used in the enroute control environment, and monitored within the TMU, as a decision support tool for departure sequencing and enroute spacing/sequencing due to its capabilities for determining fix arrival times.

Since TM personnel in Centers and TRACONS, in conjunction with the ATCSCC, are directed to employ the least restrictive methods available to minimize delays, metering at the local facility level is often one of the first choices when attempting to correct demand/capacity imbalances.

The ATCSCC monitors all departure restrictions in effect across the northeast using DSP, advisories, TELCONs, etc. to ensure that the overall flow rate is maintainable given the broader picture they are able to see. Should ESP and other local initiatives fail, or look as though they might fail, to balance capacity with demand, the ATCSCC discusses the issues with the affected facilities and a decision is reached as to what additional or replacement measures may be necessary.

The ATCSCC also is responsible for approving restrictions that result from any initiative that requires a 'tactical adjustment'. A tactical adjustment occurs when dynamic restrictions are put in place between facilities for more than one hour.

This section is broken down by flight phase and the tools used within the phase to meter aircraft. See Exhibit 5-19. Facility Use of Metering Tools indicates the systems that are installed at the listed ARTCCs and that can be used for metering. The following list indicates the metering tools that are applicable to each flight phase.

- Departure phase: DSP
- Enroute phase: URET, ESP
- Arrival phase: TMA, ASP.

Exhibit 5-19. Facility Use of Metering Tools

Center	Facility ID	ASP[1]	ESP[1]	DSP	URET	CTAS[5, 6] FFP1 (specifically, TMA)	CTAS[5, 6] FFP2 (specifically, TMA)	CTAS[5, 6] McTMA[4]
Albuquerque	ZAB							
Atlanta	ZTL	X	X		X	X	Enhanced for Multi-TRACON	
Boston	ZBW	X		X[3]			Possible	X - Planned
Chicago	ZAU				X			
Cleveland	ZOB	X	X		X			X - Planned
Denver	ZDV	X	X			X		
Fort Worth	ZFW	X				X - NASA		
Houston	ZHU	X	X				In progress - 8/03 IDU	
Indianapolis	ZID				X		Planned	
Jacksonville	ZJX							
Kansas City	ZKC	X	X		X		Planned	
Los Angeles	ZLA					X		
Memphis	ZME				X		Planned	
Miami	ZMA					X		
Minneapolis	ZMP	X				X		
New York	ZNY			X[2]				X-Planned
Oakland	ZOA		X			X		
Salt Lake City	ZLC							
Seattle	ZSE	X	X					
Washington	ZDC			X[3]				X-Planned

Notes:

[1] Most facilities are adapted for HCS ESP and ASP, however, many do not use these programs. Entries in this table indicate where HCS-based ASP and ESP programs are actually being used in Center TMUs.

[2] DSP is installed at the ZNY PIT area and at 7 busy airports in the ZNY area. It also serves more than 90 satellite airports, however, those towers do not have any DSP equipment installed, but get their clearances from specialists using DSP in the ZNY PIT.

[3] DSP at ZBW and ZDC is installed but not operationally certified as yet. At these facilities, it is currently only being used for 'common situational awareness', using data being fed from ZNY.

[4] MC-TMA will be installed at ZNY and ZOB beginning in December 2002. ZDC and ZBW are scheduled for installation beginning in January 2003. No facility will be going operational with MC-TMA, under the current schedule, till the early part of 2004. PHL TRACON is also scheduled to get MC-TMA but, due to moving to the new facility, installation and subsequent steps to IDU have been delayed. It is unlikely to go IDU until mid-2004.

[5] SCT uses what they refer to as MC-TMA, however, it is really a 'remote GUI display' – a single center version display driven by ZLA. ZLA has only an 'adjacent center data feed' from ZOA. The true MC-TMA (multi-center version) will include up to four Centers talking to and through each other. What is referred to at SCT as pFAST (Passive Final Approach Spacing Tool) is CTAS Terminal, not the discontinued CTAS pFAST component.

[6] Other TMA remote GUIs are installed at Atlanta, Miami, Minneapolis, Oakland and Denver TRACONs.

5.2.2.1 Departure Metering Tools

5.2.2.1.1 Departure Spacing Program (DSP)

DSP is used to balance demand and capacity at departure gate (meter) fixes by controlling flight departure times to space flights at the fix crossing points.

Departure sequencing has become a way of life in ZNY airspace in order to manage the large numbers of departures from 7 major and regional airports (i.e., JFK, PHL, LGA, EWR, Teterboro (TEB), Long Island Mac Arthur (ISP), and White Plains (HPN) and over 90 surrounding 'satellite' airports. See Section 6.1.5 for further information about DSP.

DSP has been installed in two other ARTCCs (ZBW and ZDC) and at the ATCSCC, where it is used only for 'common situational awareness' purposes at present. At these sites, DSP is a read-only automated version (Phase 1), displaying ZNY proposed flights only. DSP at the ATCSCC is used in the East Area for monitoring departure flows out of the New York area. ZBW and ZDC have yet to begin using the system operationally. At these Centers, DSP is occasionally being used as a means of confirming arrival times at fixes when MIT restrictions are in place.

At the ATCSCC, DSP is used in the East Area to support New York TRACON MIT restriction requests. DSP's Airport Lineup display, which shows the departure fixes for departing flights, helps the specialist decide if an MIT restriction is necessary.

ZNY PIT controllers are ultimately responsible for all departure clearances in the ZNY airspace. Within New York airspace, where there is a major airport with DSP installed, delivery of clearances is delegated to clearance delivery controllers at those airports. Where DSP is not installed (i.e., in satellite towers), local controllers call the Center directly for clearance when a flight is ready for departure. The PIT controller at the Center uses DSP to remotely ensure the following process takes place for departures from the satellite airports.

- DSP at ZNY gets its proposed flight data from the ZNY HCS via a GPO interface and processes it to produce the initial clearance delivery lineup, which displays in the PIT and is also sent to the DSP systems at the 7 major and regional airports where DSP is installed.
- The flights are initially ordered by proposed departure time and clearance status. The PIT controller reviews the lineups and checks the requested routings. He/she makes adjustments to the lineup and clearance status to accommodate events such as individual aircraft delays. The PIT controller uses the KVDT emulation window on his DSP display to send flight plan amendments/reroutes back to the Host.
- If a particular route is not available at the present time (i.e. not approved), the flight is listed in Red and is placed at the bottom of the 'ready for clearance' lineup. If the particular route has been amended, the flight is listed in Yellow to indicate a revised clearance. Revised clearances are often standardized so no further communication is required between the Center and DSP towers.

- The clearance delivery controller relays the clearance to the pilot, and then passes the strip under the DSP scanner.
- Once scanned in, DSP changes the status of the flight from Proposed to Cleared, and moves it to the Taxi lineup list.
- The local (ground) controller then sees the taxi lineup and uses that to determine when to taxi the flight out to the departure runway.
- Once taxi clearance delivery is complete, the controller again scans in the strip. DSP moves the flight to the Lineup list for the local (departure) controller, who, when the flight reaches the front of the lineup, issues departure clearance.
- One further list is provided by DSP – the Gate Hold list. This is rarely used (since there are other methods of delaying a flight), however, its purpose is to allow a controller to hold a flight at the gate when there is an EDCT in effect. Under those circumstances, the flight may be held in that list till about 5 minutes prior to the EDCT before being moved back again to the taxi list and taxiing the flight for departure.
- Prior to departure or once the flight has departed, the PIT controller may need to enter reroute information and/or a departure message to Host via the KVDT emulation available at the DSP position.

ZNY TMU specialists monitor the DSP lineups constantly, noting the number of flights scheduled by DSP to depart over the limited number of departure fixes from all airports. Using a chart (on paper), they determine the flow rate given the number of departures scheduled and then set DSP departure fix acceptance rates to distribute demand as equitably as possible. DSP adjusts scheduled departure times and the lineups accordingly.

Eventually, it is hoped that DSP will be able to monitor flows crossing departure fixes overhead or nearby on adjacent routes in order to provide a picture beyond the departure gate area, since use of DSP as an assist in merging traffic into enroute streams beyond the gate fixes is not yet viable.

5.2.2.2 Enroute Metering Tools

5.2.2.2.1 User Request Evaluation Tool (URET)

URET is not currently used much in the TMU, although traffic management benefits are derived from its use at control sectors. The TMU floor walker or supervisor monitors control sectors at all facilities, including those where URET is installed, and controllers notify the TMU when there are flow issues or reroutes are required. URET use on the floor may facilitate earlier notification of impending flow issues, which the TMC can then further investigate and mitigate.

URET flight list displays are installed in some TMUs, however, this is primarily to reduce paper (strips) and to be able to use the flight lists as a backup source of information without having to run out to the operational floor/sectors. URET provides flight data list updates and sorting more quickly than Host, but, has fewer search capabilities than Host at the current time.

Although URET was installed in the TMU in the two centers that the TFM Functional Audit Team visited (i.e., ZAU and ZDC), neither TMU made use of it.

At the present time, the primary purpose of URET with respect to metering is to reduce the need for metering flights to/from and within enroute airspaces, and to facilitate departure release decisions by reducing coordination and making merging of traffic into congested routes more efficient.

Refer to Section 6.4.10 User Request Evaluation Tool for a detailed summary of URET and how it is of benefit to traffic managers.

5.2.2.2.2 Enroute Sequencing Program (ESP)

ESP, depending on the vernacular used in a given facility, has one of the two following meanings:

- The Host ESP Application.
- The ESP Procedure.

Host ESP Application

The Host provides two metering programs, Arrival Sequencing Program (ASP) and Enroute Sequencing Program (ESP). ASP meters flights to internal airports and ESP meters flights to external airports. ESP assigns a departure time that will facilitate flight integration into an en route stream. Runway configuration and departure procedures must be considered for accurate projections. The TMU specialist performs the following activities:

- Enters ESP TM messages to produce strips and automatically acquire full data blocks on departures, arrivals, and overflight traffic specifying the appropriate destination.
- Informs appropriate sectors and ATCTs that ESP will be in effect for aircraft destined to the specified airports and routes.
- Regulates VFR services to ensure that delays are distributed equally, especially if a ground delay program is in effect for a primary airport.

If an aircraft does not depart within the designated departure window, the appropriate sector and/or ATCT contacts the TMU to obtain a new release time.

None of the facilities observed by the TFM Functional Audit Team use the HCS ESP application in executing enroute metering initiatives.

ESP Procedure

An ESP procedure is used to control departures destined to busy airports or through heavily congested airspaces. ESP is essentially a Call For Release (CFR/APREQ) procedure. Any locally developed ESP procedure is used to merge departing flights into enroute flows and may or may not also include the use of the HCS ESP application. ESP is practiced in tactical/short term strategic environments such as ARTCC and TRACON TMUs. ATCSCC specialists do not use an ESP procedure since they are primarily concerned with longer-term strategy. ESP procedures are designed to assist controllers and specialists to increase capacity during rush periods where limited routings are available and a lot of traffic is trying to access those routes within a small area. The use of ESP procedures is coordinated carefully and LOAs/SOPs may stipulate agreements for use.

The purpose of ESP is to smooth traffic flows by monitoring designated enroute sectors, determining when bunching and peaking will occur, and applying appropriate spacing. In addition, it is used to sequence departure traffic into enroute sector flows. The goal is to monitor and regulate traffic to ensure a smooth sector flow.

ESP is generally used to control departure times while keeping standard departure routes and merge points, however, it may also require fitting traffic into the stream at various points along the route to keep the flows as close to capacity as possible. Interfacility coordination may be required to achieve a change in routing to merge along very congested routes.

ESP may be required for a variety of reasons: as a pre-coordinated standard peak time traffic management initiative employed daily for flights departing to particular airports, or due to adhoc changes in acceptance rates at adjacent Center boundaries or adjacent internal airports (which may be necessitated by their rushes, weather changes or other unexpected circumstance). ESP may be employed constantly at a particular position, or only intermittently as required. ESP positions may be opened only rarely or on a regular daily schedule – depending on local facility and adjacent facility needs.

If the use of temporary ESP measures requires approval or coordination with other facilities, information about the ESP is communicated in advance of the initiative going into effect, generally verbally or using ETMS Email. These communications normally include reasons why other tactics are not viable for the current circumstances, impact assessments and plans, and reasons why the particular initiative under consideration will accommodate those circumstances more efficiently and effectively than others.

The following subsections describe how the ESP procedures are carried out in TMUs at facilities observed during the course of this audit: SCT, ZDC and ZAU. None of these observed sites use the Host ESP application.

5.2.2.2.2.1 Southern CAL TRACON (SCT)

At SCT, the ESP procedure is called CFR (Call For Release). CFR is used to schedule departures out of area airports into LAX (Los Angeles) and SAN (San Diego) through controlling departure times to accommodate LAX and SAN arrival acceptance rates (AARs). Coordination requirements and other procedures for use under the CFR at SCT are well documented in the SCT SOP. FDAD provides the local area radar display to supplement the TSD display in real time. The TSD MA function is used to set alerts for LAX AARs. Weather and flight lists are displayed/requested as required to support the planning and CFR approval processes. CFR information is entered into the SAIDS for intrafacility advisement purposes, but all coordination must be carried out by officially approved means, i.e. verbal. The SAIDS tool is described further in Section 6.3.4.

5.2.2.2.2.2 Washington ARTCC (ZDC)

At ZDC, enroute spacing (ESP) is primarily a procedural process.

During an ESP initiative, once an APREQ (approval request) notification has been given to towers, controllers must call for departure release approval on all affected flights. ESP may be initiated when grouping or bunching is observed or anticipated, according to LOA, or on request from ZNY or other Centers to reduce delivery of flights into their airspaces, particularly those bound for their local airports.

For ZDC airports, a 3-minute release window is the standard, unless otherwise coordinated. When a release time is approved, the TMC logs the following information: ACID, departure airport, arrival airport, time ready to depart, release time, and void time. Delays of more than 15 minutes due to ESP are also logged. ESP TMCs keep the Supervisory TMC (STMC) and Shift Coordinator (SC) apprised of all delays incurred during ESP, and reports delays of more than 15 minutes to the ATCSCC.

The following ZDC positions have responsibilities related to ESP initiatives:

- The STMC is responsible for ensuring that destination airports are included in ESP as necessary, and keeping the TMCs in the loop regarding the need for, or details of, a particular ESP initiative.
- The Enroute Spacing Coordinator (ESC) position provides departure release times to towers in an initial effort to accommodate spacing requirements. The ESC sequences departure aircraft into the enroute traffic flows by providing departure release times to the towers, and coordinates the departure sequence with the Operations Supervisor in Charge (OSIC) and sector controller(s), as necessary. The ESC specialist notifies towers to APREQ departures affected by ESP (i.e. flying into ZNY major airports).
- The ESP01 position provides ESP for enroute traffic and intra-center departures destined for EWR, LGA, ORD, and when necessary TEB and MMU. The TMC adjusts and coordinates the enroute flow to these airports through the OSIC and sector controller through controlled release times for internal turbojet departures. The TMC notifies each tower via the Voice Switching and Control System (VSCS), an GI message, or recorded commercial lines when a call for release (APREQ) is necessary.
- The ESP specialist monitors the TSD and DSR to ensure that controlling release times is the only measure required to accommodate departures for these specific airports. Sometimes reroutes or other initiatives must be employed to meet acceptance rate criteria, or to integrate departures into the enroute flows.
- The ESP02 position performs similar ESP functions for enroute traffic and intra-center departures for ATL, CLT, CVG and DTW.

- The ESP03 position is responsible for monitoring and providing sequencing assistance for enroute spacing of arrival traffic bound for internal airports - DCA, BWI and IAD. This position also may, as necessary, monitor major flows to other airports (JFK, BOS, MIA, FLL, MCO, etc.).

5.2.2.2.2.3 Chicago ARTCC (ZAU)

ESP at ZAU is primarily procedural and amounts to a series of implicit MIT restrictions designed to provide adequate spacing to fit traffic departing from the ZAU airports into the stream of traffic traveling on limited routes in the congested northeast corridor, most usually to the NY area. ESP can be initiated in response to MIT restrictions in place for acceptance into ZNY airspace or for arrivals to specific ZNY airports.

The tools used for ESP at ZAU include the TSD flight display with flights color-coded for each of certain major destinations (JFK, EWK, LGA primarily), and DSR for a more tactical view using range rings, with flights also filtered by destination.

Approvals and any other coordination required between ZAU TMU specialists, other local facilities, affected adjacent facilities, and/or the ATCSCC, is done verbally. The ATCSCC area specialist is advised, by advisory and telephone, if any initiative, including ESP controls, will result in delays of more than 15 minutes, or if it may impact flows to or from other facilities. The ATCSCC does not require traffic counts during delays associated with ESP initiatives. ESP delays (of more than 15 minutes) are reported and posted to OPSNET as the difference between the ready time and the release time.

Any significant activities are logged, including the start and stop time of ESP initiatives. At ZAU, any general ESP initiative in effect (requiring APREQs/Call for Release authorization) is communicated to all affected parties, using SAIDS (for ZAU local interfacility notification), the locally developed restriction manager program (for inside ZAU), and voice. At other facilities, GI messages may be used to forward initiative information to their towers/TRACONs where FDIO is installed, or verbal means may be used where no FDIO exists.

The local ESP process includes towers and TRACONs in the Chicago AOR, whose controllers or specialists call the ZAU TMU with requests for release times for individual flights destined to particular airports. The TRACON/tower controller/specialist informs the ZAU specialist of the desired departure time for the flight. The ZAU specialist then examines the TSD (and the DSR if the release time is imminent) to see what other traffic is converging on departure corridors to back up any decision made on how to fit the particular flight that will be departing into the traffic flow. Using range rings on the DSR provides the specialist with an immediate and fairly accurate visual measure of traffic spacing. If the standard separation is x nautical miles (nm), the specialist will use his/her experience and knowledge of the airspace and flight characteristics to determine where the flight might merge with the stream, and when there will be space enough to allow that. This intimate knowledge, developed over years of control and TMU involvement, aided by decision support information from the TSD and DSR is currently the way a specialist determines whether or not to approve the departure slot time.

Once a departure slot time is approved, the specialist watches the DSR to see if the flight appears on the scope within the slot window (plus or minus three (3) or some other locally determined number of minutes of the approved departure time), at the anticipated altitude and position. If the flight does not appear (i.e. did not make its departure slot time for a variety of reasons – airport lineups were too long, company problems/aircraft mechanicals/loading delays – and a slot window extension was not negotiated, the departure slot time is cancelled. The TRACON/tower specialist/controller must then call back with a new request for release.

Sometimes, due to other traffic, the specialist cannot immediately approve the departure at the requested time, and gives the TRACON/tower the reasoning. The process is usually one of negotiation so either other departure times might be suggested, or a different departure path might be a better option, allowing the flight to fit in at a different position/fix, time or altitude. The TRACON/tower may be asked to call back closer to the anticipated departure time for approval.

ESP is used often as a result of an MIT restriction (or a passback) being imposed by adjacent centers for major northeast corridor destinations in or beyond their airspaces. For instance, ZAU may be told to 'deliver traffic destined for JFK to the ZOB boundary along a specific route at x number of miles in trail'. In order to make that happen, since flight times between the two areas are relatively short, specialists may decide to control departure times for flights trying to fit into the specified route from any or all ZAU origin airports to the (JFK) destination airport as an alternative to rerouting or the possibility of having to do airborne holds at the boundary to meet the rate. Since only particular flights are impacted, ground stopping is a less desirable alternative, and a general GDP is not usually warranted.

5.2.2.3 Arrival Metering Tools

5.2.2.3.1 Traffic Management Advisor (TMA)

TMA is used to balance demand and capacity at arrival gate fixes by controlling arrival times at those fixes, effectively metering the arrival flow.

TMA provides time prediction, schedule and delay information using a graphically-based traffic flow visualization user interface. Time based information provided by the TMA allows specialists to be more aware of the arrival situation within the Center and TRACON airspace and therefore more proactive in their traffic management decisions. TMA allows for increasing airport acceptance rates (AARs), smoothing arrival flows, better delay absorption and distribution (between the Center and TRACON), and more accurate information to specialists than is available from HCS.

AAR parameters in TMA are determined by the TRACON controller/specialist. A solid line on the TMA display shows the actual airport throughput or landing rate. When the actual throughput exceeds the AAR, a technique known as 'front-loading' is being employed as a traffic management tactic. This is sometimes done purposely when an airport has been operating below its arrival rates for a period of time. Exceeding the AAR by front loading permits a faster buildup to the actual airport capacity. The front-loading period usually lasts for approximately 15 minutes during which time the TRACON may be landing aircraft at a rate of up to 25 percent above the AAR for that time period. Front-loading is often followed by a steady state landing rate for the next 30 minutes. The amount of front-loading is a decision of the Center/TRACON specialists.

TMA allows delays to be more equitably distributed among the aircraft within a rush. TMA advisories provide generally more accurate meter fix crossing times than the HCS ASP application.

Specialists can modify the sequence of the meter list using the controller sequence swap function to allow tactical considerations to be reflected in TMA advisories.

Refer to Section 6.4.9 Traffic Management Advisor for a detailed TMA description.

5.2.2.3.2 Arrival Sequencing Program (ASP)

The Host provides two metering programs, Arrival Sequencing Program (ASP) and Enroute Sequencing Program (ESP). ASP meters flights to internal airports and ESP meters flights to external airports. ASP assigns meter fix times to aircraft destined to the same airport from multiple routes. ASP is similar in concept to TMA but, as an older program, it does not provide the accuracies and all the functionality that TMA provides.

ASP was not observed to be in use at the visited sites during the Audit.

5.2.3 Assess and Implement Rerouting Strategies

This subsection provides an overview of processes, tools, and data used at both national and local traffic management facilities to manage air traffic using reroutes. Because the TM reroute process has the same phases and follows the same ground rules as all other TM initiatives, only the portions of the process that are unique to the reroute initiative are presented in this subsection. The following discusses the reroute TM initiative, i.e. the decision-making, approval, implementation, monitoring, adjustment, and cancellation of the reroute initiative. Tools used and participants involved as well as the steps of a reroute initiative are presented in this subsection.

5.2.3.1 Reroute Initiative

Rerouting of flights may be necessary due to events such as severe weather, congestion at centers/airports/fixes/sectors, NAVAID and equipment unavailability, military operations, etc. If the event has a local impact affecting only facilities within an ARTCC, rerouting initiated by the ARTCC TMC may be all that is necessary and the ARTCC TMC coordinates the rerouting initiative. However, when any event impacts more than one ARTCC (e.g., a severe weather event), the Severe Weather Management Specialist at the ATCSCC monitors the approaching event and develops a strategy to handle it. The SWAP plan may include options such as expanded MIT initiatives, reroutes, and ground delay programs. Rerouting using pre-coordinated alternative routes and procedures can minimize the impact of adverse weather within the system. Development of a reroute strategy is a collaborative process between the ATCSCC TMS, ARTCC TMCs, and Users. An ARTCC TMC may suggest several alternative reroute strategies. Adjacent ARTCC TMCs identify whether their centers will be able to handle the additional workload imposed by each reroute strategy. Users indicate their preference for one or more of the reroute strategies. The ATCSCC TMS selects the reroute strategy based on the volume of traffic affected by the closed routes, the impact of reroutes on other facilities or traffic flows, the number of facilities affected by the reroute strategy, and the degree of diversion from an FAA preferred route. The ATCSCC TMS coordinates the selected reroute strategy with all relevant ARTCCs, and the ARTCC TMCs coordinate with underlying TRACON TMCs.

5.2.3.2 Reroute Roles/Responsibilities

The primary participants involved in the development and implementation of reroute initiatives are the ATCSCC TMSs, ARTCC TMCs, and Airline Users.

ATCSCC TMS –

During SWAP, the ATCSCC has final approval authority for alternate routes and initiatives that transcend center or terminal boundaries. The ATCSCC Severe Weather Management group is responsible for severe weather management operations, ensuring coordination of alternate routes, conducting special weather TELCONs as appropriate, transmitting advisories defining severe weather areas and alternate routes, monitoring and/or modifying the reroute initiative as appropriate, and conducting a daily severe weather operations critique with affected facilities and users. The ATCSCC National Operations Manager (NOM) decides if either or both of the

Diversion Recovery Website and the Pathfinder Website need to be active during a SWAP event and, if so, instructs the TCA to activate them and monitor those sites.

ARTCC TMCs -

For a national-level rerouting initiative, the ARTCC TMCs provide the ATCSCC TMS with suggestions for reroute alternatives. Once the ATCSCC TMS selects a reroute strategy, the ARTCC TMCs coordinate it, if needed, with their underlying TRACON/ATCT TMCs.

For a local event that is due to congestion and weather anticipated within a center, the ARTCC TMUs develop the local reroute strategy. The ARTCC TMC coordinates with any affected ARTCCs and underlying TRACONs/ATCTs. If the reroutes will affect neighboring centers, the ARTCC TMC informs the ATCSCC of these activities at least two hours in advance of initiation whenever possible. Regardless if it is a local or national rerouting initiative, the ARTCC TMCs are responsible for getting the flight plan amendments entered into the Host to reflect the reroute actions.

Airline Users –

During the planning of the reroute initiative, users can express their preferences for certain routes at the TELCONs based on their assessment of the FCA and the TMS' proposed reroutes. Once a reroute strategy is in place, the users should amend their flights to comply with the reroutes. If the affected flights are already airborne, users may seek exemptions to avoid diversions. If diversions are necessary, the users must post those flights on the Diversion Recovery Website to obtain special handling from ATC to avoid additional penalty. Users who are interested in opening up the routes after a severe weather event can sign up on the Pathfinder Website to be pathfinder flights. During the entire rerouting initiative, users rely on the CCSD for the latest on traffic conditions around the severe weather area and the FEA/FCA function for impact of reroutes on their flights.

5.2.3.3 Reroute Tools/Techniques

The tools/techniques used by the TMUs for the rerouting initiative include:

Flow Evaluation Area (FEA)/Flow Constraint Area (FCA) is a function that allows a traffic manager to define a volume of airspace, the FEA, that is experiencing or forecast to experience system constraints and to see the impact of the flow constraints. The Examine FEA/FCA function on the TSD can list all the flights and counts of flights traversing and/or expected to traverse the impacted FEA for each 15-minute interval as well as the times when the flights will enter and exit the FEA. The FCA can be shared with AOCs so the airlines can see the impact the FCA has on their flights and reroute accordingly.

The ***National Playbook and Route Management Tool (RMT)*** are used by the ATCSCC Severe Weather Management Specialist as starting points in planning reroutes. National Playbook is a collection of SWAP routes that have been pre-validated and coordinated with impacted ARTCCs. The National Playbook contains the most common scenarios that occur during each severe weather season. The Playbook enables the ATCSCC Severe Weather group, the ARTCCs, and the airline ATC coordinators to look at several predetermined play options and be ready to implement them based on consensus outlook in the CCFP. Playbook routes are intended to be planned no less than 90 minutes in the future so that crews, dispatchers, and controllers can be fully informed. The Playbook route to be used during a SWAP is included in the Severe Weather Advisory. The Playbook is well suited to addressing arrival and enroute impacts. Routes in the Playbook are grouped as East-to-West transcontinental routes, West-to-East transcontinental routes, South-to North East routes, Airway Closures routes (routes for when certain airways are unavailable), and airports routes (when airports' arrival fixes are unavailable). The routes are described textually and graphically including the resource or flow impacted, facilities included, specific routes for each facility involved, and preferential and alternative routes to major destinations from the designated routes. Departure scenarios require more flexible routing than the Playbook can usually provide, making them better addressed by Coded Departure Routes (CDRs).

Coded Departure Routes (CDRs) are FAA routes designated as escape routes from cities during convective weather. CDRs are standard routes used for flights between designated origin and destination airports designed to mitigate adverse impact during periods of severe weather or other events. The RMT tool allows one to view, add and/or modify CDRs, and view the CDRs and Preferred Routes graphically on a map. Airlines usually have databases of routes that are populated with CDRs so they can easily search for the best alternate CDRs around a specific weather situation. Because everyone accesses the same CDRs, RMT facilitates coordination of reroutes among ATCSCC, TMCs, and the users. The ARTCCs and NavCanada are the primary facilities that identify, develop, and establish the CDRs. Both National Playbook and RMT tools are available from the ATCSCC Intranet website. CDR and Playbook reroute plans are also accessible via the TSD. The use of the Playbook and CDRs reduces coordination and restrictions associated with rerouting aircraft around severe weather. See Section 6.1.18, RMT, for discussion on the maintenance of CDRs.

The ***National Route Program (NRP)*** is a combination of two earlier programs, the Direct Route Program and Transcontinental Selected Fuel Conservation Routes. The purpose of the program is to provide users significant routing flexibility for flights filed at or above FL290. The NRP routes begin at 200 miles from the airport. The user submits the non-preferred route request to the ATCSCC for approval and enters 'NRP' in the remarks field of the flight plan to participate in the NRP program. NRP flights must file via any DP or STAR for the departure/arrival airport respectively, or via published preferred IFR routes, for at least that portion of flight which is within 200 nautical miles from the point of departure (egress) or destination (ingress). There are conditions for using NRP routes such as the aircraft must be equipped to fly at such altitude. The ARTCC TMUs try to avoid issuing route and/or altitude changes for aircraft that indicate 'NRP' in the flight plan except when necessary because of strategic, meteorological or other dynamic conditions. Even if the aircraft route and/or altitude are changed, the TMUs make every effort to ensure that the aircraft is returned to the original filed route/altitude as soon as conditions warrant. NRP may be suspended due to severe weather reroutes, special events, or as traffic/equipment conditions warrant. The ATCSCC is the approving authority to suspend and/or modify NRP operations for specific geographical areas or airports. Whenever NRP is unavailable for more than one hour, the ATCSCC informs the users via an advisory and TELCON.

TMSs/TMCs also use the ***TSD Reroute function*** to define and display alternate routes. The Reroute function allows one to create/modify a 'play' from the National Playbook and to search for routes in the CDR database to define alternate routes. The reroute set can then be sent via ETMS Email or with an Advisory. There are three types of reroutes: public, local, and private. Only the TMSs at ATCSCC can create public reroutes that are shared with all ETMS users. Users at the ETMS field sites may create local reroutes that are shared with other ETMS users at their facility. Any user may create private reroutes for individual viewing and use.

Local/Regional Route Tools are used by some Centers to assist them in developing routes. ZDC uses a stand-alone tool called 'RT- Find' to quickly search for local departure routes that link with SWAP routes. The routes contained in RT-Find augment the National Playbook routes by providing a 'transition' leg in front of the Playbook route. The transition leg is used to route flights from their standard route(s) to the Playbook routes. ZAU uses a SWAP Tool to search for SWAP routes from ORD and MDW to other Centers. Some Centers have 'In-house' CDRs for their own internal use. These tend to be for internal use and they are not distributed beyond the owning center.

Tunneling/Capping aircraft has been used as a tactical application to keep the system moving and to reduce departure delays. Tunneling refers to early descent of arriving traffic to avoid saturated sectors. This may be accomplished by descending from super-high to high stratum, or high to low stratum. Capping refers to restricting departures to low altitude stratum, avoiding saturated high altitude sectors. *Low Altitude Arrival/Departure Routes (LAADR)* is a combination of alternative air traffic routings and refined coordination procedures designed to mitigate the impact of extended departure delays caused by bad weather or heavy traffic. The procedure limits flights to be at FL 230 and below and is used primarily in the departure phase of the flight, but can be extended for an entire flight (normally, short legs of less than 500 nautical miles) when operationally beneficial. The use of under-utilized airspace in the lower altitudes is to reduce volume in high altitude sectors associated with rerouted and deviating traffic.

Canadian airspace offers an excellent alternative when domestic routes are impacted by severe weather. Five new routes have recently been established in Canadian airspace to improve airspace efficiency. The ATCSCC TMS often coordinates with Toronto and Montreal Centers, when necessary, to implement SWAP routes through the Canadian airspace. Toronto and Montreal Centers must, in addition, coordinate with their respective operational areas prior to accepting additional traffic from the US, so extra time is required when coordinating the use of Canadian airspace.

Special Use Airspace (SUA) provides alternative civilian routing during episodes of convective activity. Virginia Capes (VACAPES) Airspace Routes are in military controlled airspace off the East Coast and are used only when identified on an SPO or on the Severe Weather Reroute Advisory. The use of VACAPES areas requires coordination with the military. At ZDC, the Severe Weather NTMO or the NOM performs the coordination with the ATCSCC on use of VS (i.e., VACAPES) routes. Information including the VS routes and the time when the routes are opened is forwarded to the TMCs and controllers. SUAs are also discussed in Section 5.3.2, Plan for Special Government Events.

The ***Diversion Recovery Web Page (DRWP),*** accessed from the ATCSCC Intranet Website, provides the FAA and users an automated, real-time, interactive traffic management decision support system for identifying, monitoring, and tracking diverted flights through their recovery process during and after periods of significant weather or other phenomena. The diversion recovery initiative helps ensure that flights, which have already been penalized by having been diverted to other airports, do not receive additional penalties and delays. Flights identified for diversion recovery receive priority handling over other flights from their point of departure.

The ***Pathfinder Web Page (PFWP)*** allows users to inform the FAA about their capability to explore the routes around or though extreme conditions by volunteering to be a ‘Pathfinder’. A pathfinder flight must be appropriately equipped, the captain must be qualified, and other factors must be in place for a flight to be a candidate ‘pathfinder’. This website provides another mechanism to relieve congestion and reduce schedule delays during bad weather events.

5.2.3.4 Reroute Process

The following process is geared toward a national level rerouting initiative. Exhibit 5-20. Reroute Process below illustrates Steps #2 thru 20 that are described in the subsections below.

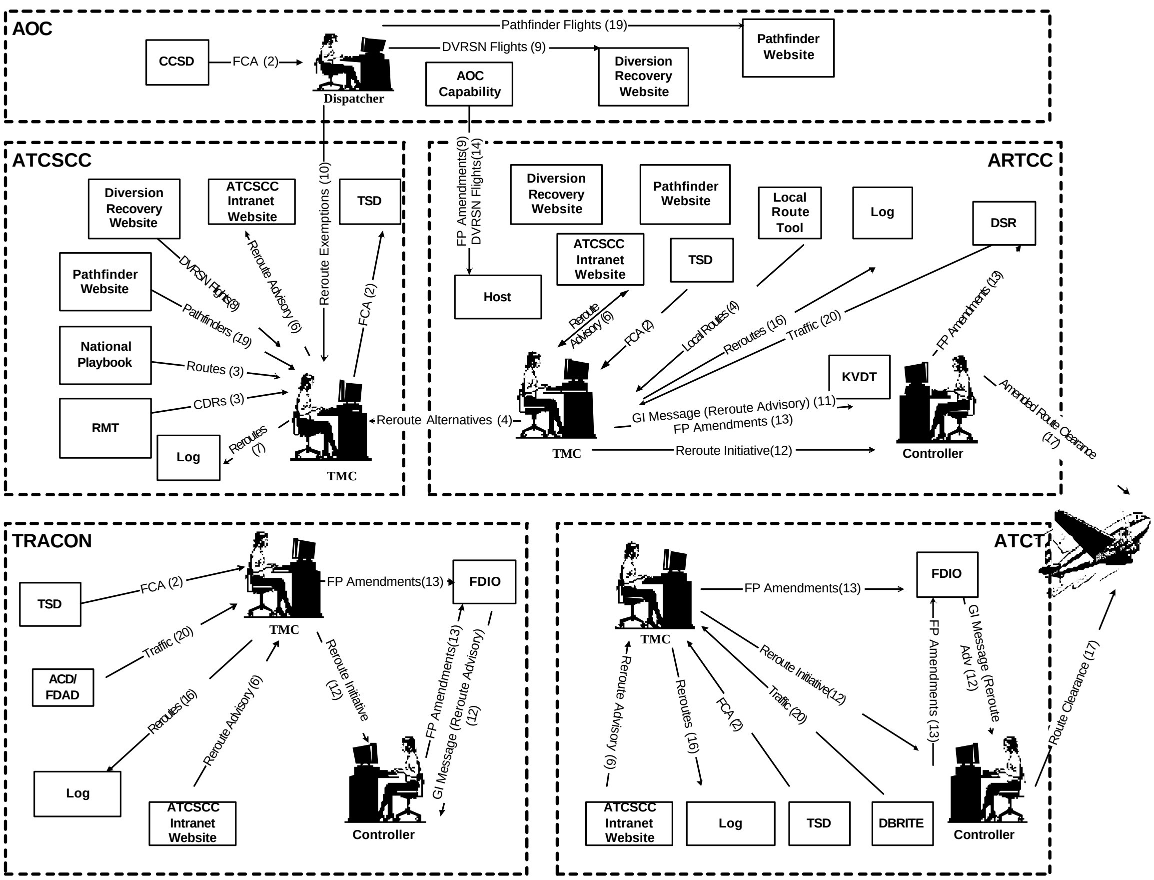

Exhibit 5-20. Reroute Process

5.2.3.4.1 Assess and Plan Reroutes

1. The ATCSCC TMS receives and reviews the weather briefing from the ATCSCC weather unit or OIS information to determine the area impacted by severe weather or other operational concern, i.e. equipment outage or flights delays. He/she discusses with field facilities the expected extent of the weather, emphasizing the time of development, affected area, tops, movement, and duration.
2. Using the TSD FEA/FCA function, the TMS examines the number of flights and filed routes impacted by the FEA, promotes an FEA to a Flow Constrained Area (FCA), and posts the FCA for distribution to the users on the CCSD. ARTCC TMCs and users also view the FCA to determine the impact on their operations. The ETMS List Server provides the list and counts of flights predicted to traverse an indicated FCA or specific location for each 15-minute interval as well as the times when the flights will enter and exit the FCA or location. AOCs can only view their own flights impacted by the FCA or constrained location. Many ARTCCs have specially designated positions, such as the SWAP position at ZMP, that primarily focus on severe weather issues and FCA evaluation.
3. The next step is to determine the initiative required. Many times the users have already made the appropriate flight plan changes around the impacted area, precluding the need for reroutes. If this is the case, the situation may be handled tactically. Alternatively, the situation may be handled with deviations or an MIT restriction. If a reroute plan is necessary, the TMS develops reroutes using the TSD Reroute function, drawing from existing routes in the National Playbook or CDRs. As the Playbook and CDRs do not address every situation, it may be necessary for the TMS to create routes ad hoc using the Reroute function. Specialists may utilize routes through Canadian airspace if domestic routes are already severely impacted.
4. Via the SPT or another TELCON, the TMS presents the reroute plan with affected facilities and users and solicits input from the facilities and users. The ARTCC TMCs may suggest alternative reroute strategies and/or provide input of the reroutes' impact to their centers' workload. ARTCCs usually have common departure, arrival, and enroute reroutes based on frequently impacted areas. Many use the Playbook routes for arrival swaps and CDRs for departure swaps. For example, common swap routes from ORD and MDW airports are coordinated CDRs that are fully documented within the ORD Swap Book. Some ARTCCs have SUAs that restrict their operational flexibility during swaps. For example, Wallops Island and Patuxent are SUAs within ZDC that significantly restrict ZDC's flexibility in accommodating deviations or alternate routes. However, use of warning area airspace is an option that accommodates civilian deviations during episodes of convective activity. At the SPT or TELCON, users can indicate their preferences for reroute strategies and/or request exemptions for fuel-critical flights. The reroute strategy is adjusted per facility and user input, and the participants agree to the reroute strategy. Notifications are made 30 minutes prior to implementation of a SWAP

5.2.3.4.2 Implement Reroutes

5. Once a reroute strategy is decided, the ATCSCC TMS uses TSD to forward a Severe Weather Reroute Advisory via ETMS Mail. The FCA name and number appears on the Reroute Advisory along with severe weather areas, alternate routes, and estimated delays.
6. The ATCSCC TMS posts the Reroute Advisory on the ATCSCC Intranet Website.
7. The Severe Weather Management Specialist at the ATCSCC records the Reroute Advisory in the ETMS Log.
8. The ATCSCC may announce that the Diversion Recovery Website (DRWP) on the ATCSCC Intranet Website is opened, thus allowing users (airlines, NBAA members, even military) to add flights as diversion recovery flights and to request priority release (special handling) of diversion recovery flights. When a diversion recovery event is in progress, the users inform the TCA of their diversion recovery flights and the TCA advises the Centers of their special status.
9. Users modify flight plans (AM messages) for affected flights that are in the planning and filed phase (i.e., prior to strip printing). If the rerouting requires a flight to be diverted, a recovery 'leg' needs to be created in ETMS (via a FC message) with 'DVRSN' specified in field 11 of the flight plan. An airline with multiple flights at the same airport with the same destination will be prioritized based on their proposed times. ETMS detects 'DVRSN' in field 11 of the flight plans and places these diversion recovery flights on the Diversion Recovery Web page. Users who examine the Counts Page on the DRWP site may see that there are too many flights diverted to an airport and may change the destination of one or more diversion recovery flights. Airlines are advised to hold off filing untill they have found the best routes based on the most up-to-date weather information, but to file no later than 45 minutes before coordination (P-time) time.
10. Users submit requests for exemptions from rerouting to the TCA who works with the Severe Weather Specialist for approval on a case-by-case basis.
11. ARTCC TMUs forward the Reroute Advisory to Controllers via a GI message using the KVDT or DSR whichever is available.
12. ARTCC / TRACON / ATCT controllers and the TRACON / ATCT TMCs receive the Reroute Advisory via the GI message from Host. Also the TMCs communicate the Reroute initiative to the controllers via one or more of the following ways:
    - Phone
    - Supervisor
    - OIS
    - SAIDS if used at that facility
    - ESIS if used at that facility
    - Floor Walker if such position exists at that facility.

13. For flights in the filed phase where the strips are already printed, ARTCC TMCs submit flight plan amendments (i.e., AM messages) to the Host via KVDT or DSR. ARTCC TMCs may request TRACON/ATCT TMCs for assistance in amending flight plans using the FDIO. TRACON/ATCT TMCs may also request controllers to help with amending flight plans using the FDIO. However it is the ARTCC TMCs who are responsible for getting the amendments entered into the Host.
14. If a flight destination has changed after the flight is airborne, usually due to an imposed diversion, a CDM participating airline is required to submit a FM message to ETMS, noting the change of destination.
15. Host forwards the flight plan amendments (AF messages) to the ETMS Hub.
16. TMCs record the rerouting event on the facility log(s) such as the ETMS Log, TMLog, and/or local tool such as the TMU Log at ZAU. All facilities use a facility SWAP Checklist.
17. The enroute sector controller delivers amended route clearances to the pilot if the flight is already airborne. If the flight was rerouted prior to departure, the ATCT departure controller delivers the amended route clearance to the pilot at departure. Towers provide expeditious handling of flights identified as diversion recovery flights.
18. Updates from Host on a diversion recovery flight are updated on the Diversion Recovery website.
19. When there is doubt as to whether there is a route available during bad weather or there is a need to determine the end of a weather event, users may sign up on the Pathfinder Website to be a 'pathfinder'. The ATCSCC looks for pathfinders to reopen routes. The TCA monitors the Pathfinder website and coordinates pathfinder flights with the airlines and applicable facilities. Some TMCs, such as the Departure Director at N90, coordinate pathfinders at regular intervals in attempt to reopen routes.

5.2.3.4.3 Monitor and Adjust Reroutes

20. The ATCSCC TMS monitors the severe weather and demand at rerouted areas to determine if reroutes need to be adjusted. If adjustments are needed, the ATCSCC TMS reinitiates a TELCON to discuss continued rerouting and adjustments. The process may need to be repeated starting at Step #4.

5.2.3.4.4 Cancel Reroutes

21. When reroutes are no longer needed (i.e. canceling a SWAP, congestion cleared, etc.), the TMS issues an advisory indicating when normal routings can resume.

5.2.4 Assess and Implement Other Airborne Delay Strategies

This subsection describes the processes, tools and data used at both national and local traffic management facilities to identify possible airborne holding strategies to use if other TM initiatives are not effective or cannot/should not be employed for the problem currently being considered.

Airborne delays may be incurred from some point in the climb out (usually beyond the departure fix) to some point in the arrival descent (after Top of Descent (TOD)) profile.

Alternatives to Airborne Delay Strategies are GDPs, GSs, and MIT restrictions. GDPs and GSs prevent airborne delays but may result in underutilization of arrival capacity because of changing demand. MIT restrictions create an airborne reservoir and may result in greater airborne holding costs and increased air traffic control workload.

5.2.4.1 Airborne Delay Strategies

ATC initiated airborne delay strategies can include vectoring (‘doglegs’ and route offsets), corner post swapping (redirecting traffic to other arrival fixes to balance fix loads), and holding. Controllers, most often, are the first to initiate vectoring and holding for a limited number of flights. The TMU monitors the situation and gets involved if these strategies are being applied repetitively.

Specialists in the TMU keep track of locally implemented short term delay strategies through frequent verbal contact with sector supervisors, by watching the radar display at their positions, or through the floorwalker who travels throughout the facility relaying current traffic information to the TMU. If the controller-initiated strategy is insufficient to absorb airborne delay, the TMU begins to determine what the next step should be.

Vectoring. Vectoring activities rarely take flights into other sectors. Controllers advise the TMU of anticipated delay and delay mitigation strategies being employed.

Vectoring delay may be applied prior to an MIT to produce the spacing necessary for the MIT, or even eliminate the need for an MIT. Spacing maneuvers for MIT may have to start several sectors upstream. If an MIT is in place, the ATCSCC monitors its implementation, and advises other facilities if restrictions need to be put in place to accommodate an upstream MIT. Often facilities, particularly in the northeast corridor, have LOAs in effect to deal with near constant application of MIT into and out of their airspaces. For further information on MIT application and tools, see Section 5.2.1 Assess and Implement Restrictions.

Holding. Holding may be initiated regularly by local procedure (developed due to airspace configuration, local weather patterns, or peak traffic patterns), or just occasionally when saturation occurs. Traffic managers also sometimes use airborne holding to determine the need for a GDP.

The first option considered may be to accept arrivals above the normal AAR to maintain maximum pressure on the airport capacity rate. However, when this measure does not work, holding may be the next option, followed by MITs implemented prior to the arrival fixe(s).

As traffic increases and holds are more frequent, the TMU gets involved. When it appears that holding a few flights is not resolving the problem, and the problem is passed back to previous sectors or facilities, the ATCSCC becomes involved, especially if delay is passed back beyond the first tier. The ATCSCC specialists monitor the situation carefully, and begin looking at GDP options. In the interim, flights may be held prior to crossing facility boundaries in order to build spacing and/or MIT restrictions may be initiated at the arrival fixes.

The number of published holding areas and the allowable holding altitudes limit the number of flights that can be held in an airspace/sector, particularly in congested arrival airspaces.

Departures are affected by arrival holds since they must be kept clear of any hold areas in use, further increasing delays and congestion. Sometimes, it is necessary to delay departures to deal with a growing number of arrivals placed in holds. If an arrival sector/facility cannot hold more flights, the need for slowing down the number of aircraft who can arrive in that airspace is passed back to the previous sectors/facilities.

Other than through constant visual monitoring and verbal contact with local facilities throughout the day, controller use of airborne holding tactics may be detected by specialists through analysis of performance metrics numbers for actual vs planned enroute flight times, and data mining to find actual evidence of a TM Initiative prescribing airborne holding.

5.2.4.2 Tools to Support Airborne Holding Initiatives

The following tools are used in support of operational airborne holding initiatives in real time: Radar Display, ETMS (specifically, TSD/WSD), FSM, and RT FSA. POET is used for post-analysis of airborne holding.

Exhibit 5-21. Tools that Support Airborne Holding Initiatives summarizes how these tools are used to support airborne holding initiatives. The subsections that follow the table provide a more thorough discussion of the tools in the context of airborne holding.

Exhibit 5-21. Tools that Support Airborne Holding Initiatives

TFM Tool	Description of How Tool is Used for Airborne Delay Strategies (such as Airborne Holding)	Reference to Functional Audit Tool Description
TSD	The specialist watches the density of traffic flows to arrival fixes or boundary crossing points to pinpoint bottlenecks that may cause airborne delays. Flight lists may be pulled to determine flights that may be affected by delay. ETMS displays flights in a hold as a racetrack icon.	6.1.23
DSR (if ARTCC) or ACD/FDAD (if TRACON)	The tactical view of the center is filtered to show enroute and/or arrival flows. Hold lists show flights in holds. DSR does not display data blocks for flights in holds, but, the symbol is changed to indicate the flight is in a hold.	6.4.3 (DSR) 6.4.1 (ACD) 6.4.5 (FDAD)
FSM	FSM allows specialists to model anticipated airborne holding delays as a part of the analysis often preceding the decision to implement a GDP. Produces an Airborne Holding Flight List and Carrier Statistics report.	6.1.14
POET	Provides data mining and modeling capabilities that can be used to determine airports with the most delay caused by holding, and animation used to examine flights entering holds.	6.1.17
RT FSA	RT FSA Performance Report includes airborne holding delays. FSA measures GDP performance using airborne holding delays as one criteria.	6.1.13

5.2.4.2.1 Radar Display

Specialists in ARTCCs and some TRACONs may use the available radar display to visually monitor the number of holds being given to traffic bound for busy arrival fixes. Host does not currently track flights in a hold, but replaces the symbol so these are identifiable. Hold Lists can also provide some of this information. DSR is available in the ARTCC for viewing radar tracks and either ACD or FDAD is available in the TRACON for viewing radar tracks.

5.2.4.2.2 ETMS (TSD/WSD)

When displaying live data, the TSD indicates the position of each airborne flight by an airplane or triangular-shaped icon (indicating aircraft type class), a dot, or an oval (indicating a flight in holding and also referred to as a racetrack icon).

Specialists may look at data about each flight by requesting data blocks and/or flight paths. Data blocks show flight data in text form, including the flight ID, aircraft type, flight level, ground speed, estimated time to arrival, and optionally the origin/destination or filed flight path (i.e., Field 10). Flight paths are drawn graphically, overlaid on the maps. ETMS updates live flight positions every minute which is a fast enough update rate to provide the specialist with a good indication of whether a flight is flying a hold pattern.

5.2.4.2.3 FSM

The ATCSCC uses FSM for traffic management decision-making throughout the NAS. Utilizing FSM's modeling and analysis capabilities, FAA specialists run a series of possible traffic initiatives, including airborne holding, ground delay and ground stops. The FAA currently uses FSM to implement and manage all U.S. ground delay programs.

- FSM allows TMCs to predict the expected amount of delay that might be incurred if a flight or flights were put into holds enroute during a GDP.
- FSM allows specialists to model anticipated airborne holding delays as a part of the analysis often preceding the decision to implement a GDP.

The airborne holding algorithm in FSM produces the amount of expected airborne holding delay that would ensue from running a GDP.

The specialist uses the FSM GDP mode to access and modify the Airborne Holding setup panel. FSM uses the AAR inputs for the entered time period to produce two types of reports: Carrier Statistics (airborne delay by carrier) and Airborne Holding Flight List (all flights which would be affected by having airborne delays imposed on them under a GDP during the specified time period). Exhibit 5-22. FSM Airborne Holding Flight List below shows an example of an Airborne Holding Flight List. Data in this report includes, for each flight, the carrier, flight ID, departure and destination airports, ETD, ETA, and the arrival slot time the flight would be assigned under the GDP. From this report, the specialist can request and view the Airborne Holding Delay Histogram, which depicts graphically the distribution of the expected airborne holds (in time chunks, the number of flights for which airborne delays will be imposed).

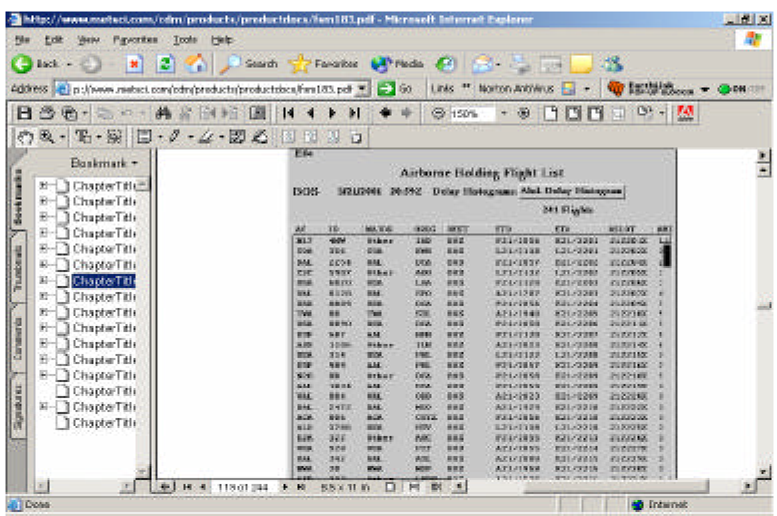

Exhibit 5-22. FSM Airborne Holding Flight List

The Carrier Statistics report is used for examining equity issues, and also for monitoring airborne delay (as well as absolute delay which includes both FAA-imposed and airline delays) during a program. This tool is used by both TMSs and airlines. The latter may use the Carrier Statistics Report to determine how a particular program affects their specific carrier(s), however, other carrier flights are masked so they cannot view the details for other airlines.

Any time a GDP is adjusted, the TMS may revisit the impacts for airborne flights and determine how any incurred delay may be absorbed. ATC may elect to absorb the delay enroute with holds, offset routings, or doglegs in the filed route rather than with reroutes. Carriers may elect to file different routes or take a chance on arriving at the destination only to be stacked in a hold nearer to the destination. The process is often one of negotiation between carriers and their pilots, carriers and the TMU/ATCSCC, the TMU/ATCSCC and ATC in an attempt to smooth operations and accommodate the original needs for the program/delay (e.g., weather or the alleviation of congestion enroute or at destination).

If a flight has not departed and the carrier learns that a GDP in effect may cause the flight to experience an airborne delay enroute or at destination, the airline reviews its priorities and decides on a course of action based on what it believes are the chances that the delay will indeed happen (i.e. for a long flight there is a chance that the situation will have been resolved by the time the flight reaches its destination, which may not hold true for a short flight). If the airline has a choice, it may elect to cancel or postpone the departure of that flight.

On the ATCSCC/TMU side, consideration is given to distributing airborne (and other delays) as 'equitably' as possible. However, once a delay of any kind is issued, compliance is also monitored to ensure that airlines do not attempt to minimize their delay at the expense of other airlines and general traffic.

5.2.4.2.4 RT FSA

Real Time (RT) FSA is available, via the OIS pages, to both TMSs and the airlines. The RT FSA Performance Report that it provides includes detection of airborne holding delays. Large positive enroute time estimate (ETE) fluctuations for flights that have departed may be an indication of airborne holding. Traffic management specialists at airlines and the ATCSCC can drill down to find details for specific flights to determine what exactly is happening.

RT FSA may also be used to monitor pop-ups (i.e., flights for which ETMS has no schedule information) to GDP airports. Pop-ups affect the accuracy of the demand prediction at a GDP airport because popup flights are not included in the ADL used to create the GDP. Pop-ups may lead to additional delays and may result in additional traffic management initiatives, such as airborne holding, MIT, or ground stops. RT FSA uses ADL information to determine when the popup first appeared.

To reduce the possibility of, or to better estimate the real probability of, airborne delay (or delays in general) specialists may consult a variety of reports to determine if pop-ups are a big factor in projected demand, whether there are duplicate flights and whether there are other bogus flights included in the projected demand. RT FSA may be used to provide much of this information. Airlines are able to use RT FSA reports to determine if there are problems on their side, of which they have been unaware, that can be internally addressed to make demand prediction more accurate.

For further details on RT FSA capabilities, see the Airline Training Document For Real-Time FSA Version 2.3 document and the RT FSA PowerPoint presentation available on the CDM website.

5.2.4.2.5 POET

POET has a built-in collection of powerful data mining tools to recognize patterns and trends during post analysis. Some of the patterns currently recognized include circular airborne holding, arrival fix swaps and flown routes that differ significantly from the routes filed. POET has the further capability to integrate FAA data with airline-provided flight data (when available), to give a more complete picture of what is happening in the NAS.

Poet allows TMSs to review holding delays after the fact by generating Advanced Charts showing the Top 10 Arrival Airports with Circular Holding (see Exhibit 5-23. POET Top 10 Airports with Circular Holding below for an example of the bar chart generated). Circular Holding tells the specialist the number of flights within a flight group for which a circular holding pattern was detected in the actual flight track.

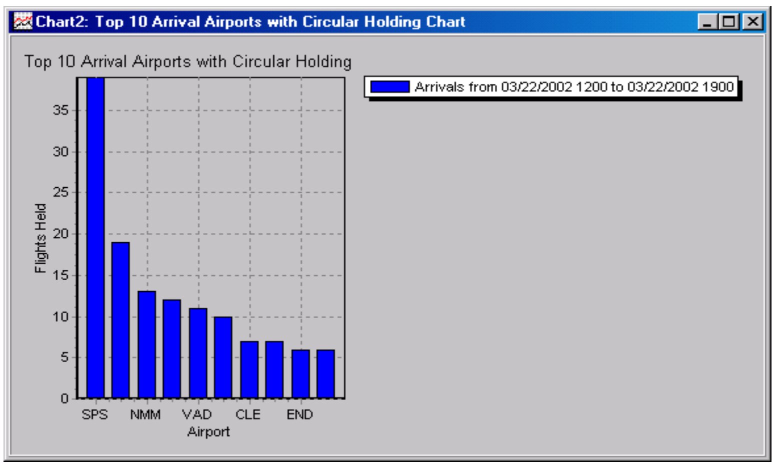

Exhibit 5-23. POET Top 10 Airports with Circular Holding

Specialists can also view events for a day in motion using the POET Map's animation capability. This allows them to play back the time/position history of selected flights and weather events. They may use this function to examine when and where flights entered a holding pattern.

5.2.5 Assess and Implement Ground Delay Strategies

This subsection describes the processes, tools, and data used at both national and local traffic management facilities to manage traffic using ground delay operations. The following discusses the Ground Delay Program and Ground Stop initiatives, the decision-making, approval, implementation, monitoring, adjustment, and cancellation of ground delay operations. Tools used and the participants involved as well as the steps of Ground Delay Program and Ground Stop initiatives are presented in this subsection.

5.2.5.1 Ground Delay Operations – GDP and GS

A Ground Delay Program (GDP) and a Ground Stop (GS) are two types of ground delay operations. GDP and GS are the most restrictive type of traffic management initiatives. GDPs are national initiatives of delays of over 1 hour and are planned 3-4 hours in advance, whereas GSs usually are implemented immediately and can be either locally or nationally implemented. A GS of 30 minutes or less is implemented as a local initiative and those that are longer are typically implemented nationally.

Another difference between GDP and GS is that GDP is predicated on arrival times at the destination while GS is predicated on departure times at the origin. Implementation of national or local ground delay programs are predicated on actual or projected constraints such as available runways, runway configuration, airport movement areas, en route and local initiatives, equipment or NAVAID failures, weather phenomena, arrival and departure demand, and/or terminal sector saturation. Lengthy periods of demand exceeding acceptance rate are normally a result of the airport's acceptance rate being reduced for some reason. The most common reason for a reduction in acceptance rate is adverse weather such as low ceilings and visibility.

Ground delay operation (GDP and GS) is a collaborative process between the FAA and the users (AOCs), a collaborative process greatly enhanced by the use of the most current schedule information from ETMS, the sharing of common situation data between the FAA and users, and the use of a common tool, the Flight Schedule Monitor (FSM) by both the FAA and airlines. The process allows for interaction and planning between the FAA and airlines and encourages the airlines to contribute updates on the status of flights.

5.2.5.1.1 Ground Delay Program (GDP)

Ground Delay Programs are implemented to control air traffic volume to airports where the projected traffic demand is expected to exceed the airport's acceptance rate for a lengthy period of time. The purpose of ground delay programs is to limit airborne holding and to assign delays equitably to all system users. GDPs are implemented, coordinated, and managed by the ATCSCC and NavCanada.

How it works

Flights that are destined to the affected airport are issued Estimated Departure Clearance Times (EDCT) at their point of departure. These EDCTs are calculated in such a way as to meter the rate that traffic arrives at the affected airport, ensuring that demand is equal to acceptance rate. When a GDP is implemented, all aircraft in the GDP program are expected to depart within 5 minutes, i.e. 5 minutes before or 5 minutes after ('+-5'), of their assigned EDCT. If the EDCT has passed and the aircraft has already begun taxing, it is released unless a GS applicable to that aircraft is in effect. If EDCT has passed and the aircraft has not begun taxing, then that aircraft gets a revised EDCT based on the Fuel Advisory (FA) information, the Estimated Time En Route (ETE), and new proposal time. An FA delay time is the average delay time during a GDP. Flights exempt from a GDP are lifeguard flights, international flights, active flights, and flights within 45 minutes (an adjustable time) of departure.

Substitutions

During the GDP process, users have the option of substituting flights. A user can reassign a Controlled Time of Arrival (CTA) slot by canceling the flight assigned and substituting another. The vacated CTA slot of the substituted flight can then be reassigned to another of the user's flights. This process continues for all remaining user slots. Since April 2002, SI messages used by the airlines for the substitution process are replaced by the use of FM and FC messages to denote flight substitutions and cancellations.

Compression

Compression is an inter-airline slot swapping process to move flights up into open slots. Compression reduces delay and smoothes out arrival demand. During a GDP, the ATCSCC TMS periodically runs compression to minimize the number of unused slots. Compression tries to place flights from the same airline that created the unused arrival slot into that slot. However if this is not possible, other airlines' flights are used to fill the arrival slots. Compression can only be run at the ATCSCC.

Revision and Extensions

GDPs are continually monitored by the TMS to assess the need for revision and extension. GDP revisions and extensions allow GDP parameters such as AAR, the centers included, and the program end-time to be modified to adapt to changing conditions. A GDP should be limited to a maximum of 10 hours when practical.

5.2.5.1.2 Ground Stop (GS)

Ground Stop (GS) is a process whereby an immediate constraint can be placed on system demand. The constraint can be total or partial. The ground stop may be used when an area, center, sector, or airport experiences a significant reduction in capacity. The reduced capacity may be the result of weather, runway, closures, major component failures, or any other event that would render a facility unable to continue providing air traffic service. Ground Stops should be used: in time-critical situations, in severely reduced capacity situations (i.e. airport/runway closed for snow removal or aircraft accidents), to preclude extended periods of airborne holding, and to preclude sector/center reaching near saturation levels or airport gridlock. A GS can be applied to a single group of flights or to all flights at a particular airport.

Unlike a GDP which delays flights because of a reduced airport arrival rate (AAR), the GS initiative prevents flights from departing at all until further notice.

GSs are usually initiated by ATCTs or ARTCCs and implemented/coordinated locally by the ARTCC TMCs. The ATCSCC is informed of delays and enters the information into the FSM, but the authority/decision about a local GS lies with the TMC that issued it. When a GS is executed, the TMU remains the authority unless the GS is expected to last for more than 30 minutes or has to be run out to the second tier – in which case the ATCSCC becomes involved. In a GS, a flight's Estimated Time of Departure (ETD) is checked against the GS' Start Time and End Time parameters to determine whether the flight will be included in the ground stop. In a GDP, these times are checked against the flight's Estimated Time of Arrival (ETA). All flights that are included in a GS are assigned a new Controlled Time of Departure (CTD) of 1 minute after the GS End Time. The new ETA is based on the CTD plus the flights' original Estimated Time Enroute (ETE).

One of the differences between a GDP and a GS is that slot assignments and control times generated for a GS are sent to the airlines to advise them of the ground stop, but the control times are not sent to the TMUs. A GS does not cause CT messages to be generated. A GDP does.

As in GDP, FSM is the primary tool to initiate, model, communicate, and monitor a GS. It is recommended that TMCs use FSM to implement ground stops. However some do not use this tool, but instead use locally developed tools or just use the phone to coordinate ground stop initiatives.

5.2.5.2 GDP/GS Roles/Responsibilities

The major participants in a ground delay operation are the ATCSCC TMSs, ARTCC TMCs, and the airline users.

5.2.5.2.1 ATCSCC

The ATCSCC is responsible for all national GDPs. The TMSs implement, modify, and terminate GDPs. They assess and model a potential GDP initiative, determine the GDP parameters and length of the delay program, initiate the TELCONs to coordinate the GDP operation, and issue the advisories. They monitor the GDPs and revise/extend the GDPs as necessary to ensure appropriate numbers of aircraft are being processed through the GDP and that the delays are distributed equitably throughout the timeframe of the GDP. Only the TMSs have the authority to update the AARs when issuing a ground delay program.

The ATCSCC is also responsible for authorizing ground stops of more than 30 minutes and ground stops that affect more than one center.

5.2.5.2.2 ARTCCs

In the event of a national ground delay operation, the ARTCC TMCs coordinate with the underlying TRACON/ATCT TMCs to implement the program. For a GS, the ARTCC TMCs implement and monitor the event. If a local ground stop is expected to exceed 15 minutes, the ARTCC TMCs inform the ATCSCC. If local ground stops are to exceed 30 minutes, the ARTCC TMC obtains approval from the ATCSCC.

5.2.5.2.3 Airline Users

Airline users play an integral part in ground delay operations. Activities performed by the airlines during GDP/GS initiatives include:

Cancellations - In anticipation of a potential GDP, airlines can submit flight cancellations. Sometimes cancellations of some flights by the airlines are enough to reduce demand such that a ground delay operation is not necessary.

Substitutions - Substitution is the exchange of Controlled Time of Arrivals (CTAs) between flights of the same company or company affiliates. Substitutions allow airlines to react to the GDP to reflect their own dispatching priorities. Users can only substitute flights that are already included in a ground delay program. Substitutions are implemented as single messages (FM and FX messages) that are sent to the ATCSCC via the ARINC interface to assign flights to slots.

EDCT compliance – Airlines are responsible for operating to ensure EDCT compliance. Airline procedures must ensure that flights are at the end of the runway ready to takeoff when the EDCT is due, accounting for departure runway configurations, taxi route conditions, airport departure congestion, etc. Airlines need to keep their crews apprised of new/revised EDCTs.

Intermediate Landings - During a GDP, airlines may exercise other options such as intermediate landings. Intermediate landings should be approved where requested. When approved, a flight should land at the intermediate airport to provide the delay necessary for the flight to arrive at the CTA.

5.2.5.3 GDP/GS Tools/Strategies

The tools/techniques used by TMUs for ground delay operations include:

FSM is the main tool for the ATCSCC to monitor demands and model, implement, and monitor the ground delay operations. FSM has replaced the ETMS Delay Manager tool for use in GDP and GS. The FAA and airlines monitor airport demand using FSM. Each FSM user gets an updated picture every 5 minutes of the demand for all the airports it FSM monitors. Updates are synchronized so that all users see the same demand. Data shown on FSM reflects current schedule updates from the airlines as well as flight and track data from the Host. If enroute congestion is considered to be significant in duration and severity, the ARTCC TMC may request the ATCSCC to implement a GDP, or if the projected demand/capacity imbalance is at an en route fix, route, or sector, a GDP may be necessary. The ATCSCC models the traffic to determine the centers, start/end times, AAR, and other parameters for a GDP.

The ability to construct ‘what if’ scenarios in FSM allows the FAA and users to determine the best option (i.e. the best parameters) for a delay operation, one that minimizes impact on air carrier operations and maximizes efficiency during adverse conditions. FSM’s modeling tools include the Airborne Holding function that produces the amount of expected airborne holding delay that would result from running a GDP. The Carrier Statistics Report displays specific delay information for each carrier's flights. The Airborne Holding Flight List includes the flights' arrival slots for specific GDP parameters. Airline users can use an FSM modeling function to cancel or delay specific flights to see the effects under a certain GDP. TMCs and AOCs can monitor traffic demand and delay operations using the FSM Slot list.

Some of the reports and alarms from FSM used for monitoring a program's progress are:

- Carrier Statistics – total minutes of delay for each airline (% Delay vs. % Traffic); summarizes delay equity for a carrier at an airport.
- Surface Delay Report – histograms of both absolute delay and ATC delay.
- CTA Compliance Alarm – alarm triggered for flights that have violated arrival compliance (i.e., the flight arrives more than 5 minutes before to more than 5 minutes after its CTA).
- CTD Compliance Alarm – alarm triggered for flights that have violated departure compliance (i.e., the flight departs more than 5 minutes before to more than 5 minutes after its EDCT).
- Actual ETE vs. Original ETE Alarm – alarm triggered when the difference between the ETE estimated by ETMS and the actual flight time is greater than a specified value.
- Spurious Flights Alarm – alarm triggered when cancellation of false flights (i.e., no OAG entries) was used to ignite a substitution stream.

Real-time FSA is a web-based application that generates a collection of dynamic web-based reports including: (1) Performance; (2) Flight status; (3) Compliance; (4) Cancelled flights that operated; (5) Pop-up flights; (6) Time-out delayed flights; and (7) GDP Program events. These reports are dynamically updated every five minutes as new flight information is received. Drill-down features allow the user to interactively query the database for additional flight information. Real time FSA is used to assess the effectiveness of GDP. Real time FSA is accessed from the ATCSCC Intranet web site.

ETMS Autosend is used by Traffic Management Specialists at the ATCSCC to automatically construct the advisories and data files needed to implement a ground delay program using Fuel Advisory Delay Table (FADT) reports. Constructed data files include delay times as well as advisories to be sent through NADIN, the ARINC Network, or to other ETMS workstations. Once advisories have been created, Traffic Management Specialists at the ATCSCC and NavCanada can send them through ETMS EMail.

TMShell provides an alternative capability to enter EDCT commands to access traffic management data and control GDP processing. EDCT commands via TSD, TMShell, or FSM can extract GDP data from the database, manually update data, and control GDP processing as needed. The GDP data includes:

- List of current GDPs

- Substitution status of GDPs
- Flight details for selected airports (airlines see only their own flights)
- History of action taken by the FAA and airlines.

EDCT commands can provide reports such as:

- List of all airports currently controlled by EDCT programs.
- List of flights cancelled in EDCT programs for selected airports or specified airlines for selected airports.

ETMS Log/TMLog is used for logging the ground delay initiatives. The information logged for a GDP advisory include: Weather; demand for the affected airport or other affected NAS element, based on a flight count report; justification for AAR; average/maximum delays; and the number of aircraft affected for all scenarios considered (first tier, second tier, etc.).

The above tools are also described in Section 6, TFM Tools and Products.

5.2.5.4 GDP Process

Exhibit 5-24. Ground Delay Program Process illustrates Steps #2 through #22 (described below) of a national Ground Delay Program scenario.

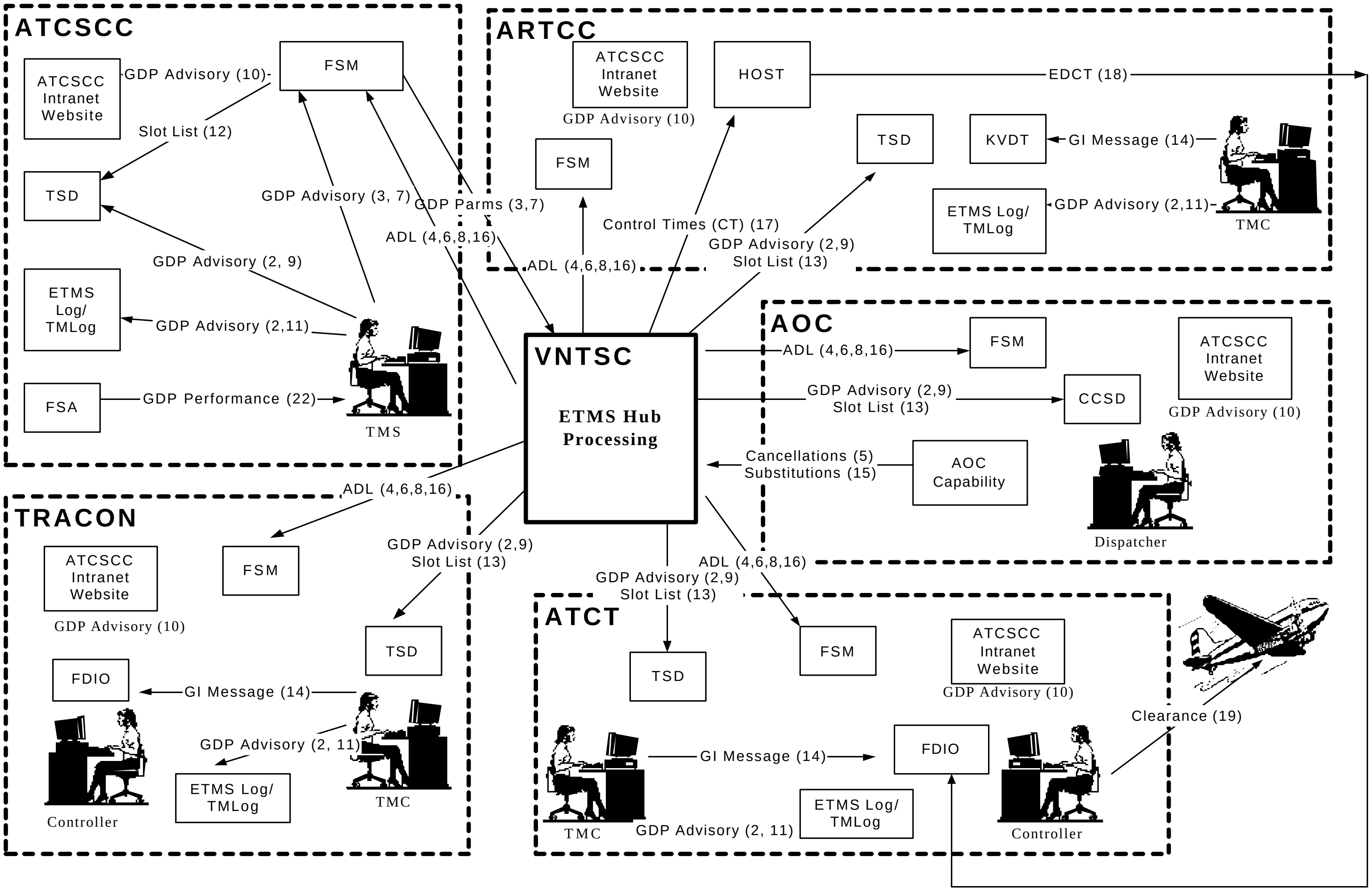

Exhibit 5-24. Ground Delay Program Process

1. The ATCSCC initiates a TELCON to obtain input from TMCs and users to assess impact on facilities and users and to obtain agreement on the GDP parameters. TRACON, ARTCC, or Tower TMCs may recommend or provide opinions about an upcoming GDP. AOCs may suggest a different AAR. But the ATCSCC makes the final decision on the GDP and its parameters. A facility sometimes recommends a higher AAR than indicated to 'keep pressure on the fixes'. This is done in an attempt to reduce the amount of traffic waiting when a GDP ends and thus minimize/eliminate the need for imposing any post-GDP initiatives such as an MIT.

2. The ATCSCC TMS uses ETMS Email from the TSD to issue a proposed GDP advisory. The proposed GDP advisory is forwarded to TSD/CCSD users. The advisory includes the reason for the program, proposed program AAR, anticipated delays, and the ARTCCs included in the program. The TMS logs the proposed GDP advisory with the following information: Weather; demand for the affected airport or other affected NAS element, based on a flight count report; justification for the AAR; and average/maximum delays and number of aircraft affected for all scenarios considered (first tier, second tier, etc.). TMCs also record the proposed GDP advisory in the ETMS Log, TMLog, and/or local Log tool.

3. The ATCSCC TMS issues a Proposed GDP Advisory using FSM based on the agreed GDP parameters. The Advisory includes a time when users must respond (usually the current time plus 30 minutes). FSM at the ATCSCC forwards the proposed GDP parameters to ETMS for Hubsite processing.

4. The ETMS Hubsite updates the ADL with the proposed GDP parameters and forwards the updated ADL to all requesting FSMs at the next 5-minute update interval.

5. AOCs using FSM can model the GDP with the proposed AAR to evaluate the impact it will have on their operations. Some may cancel flights by submitting cancellation (FX) messages. Sometimes the cancellation of some flights may be enough to reduce demand and possibly avoid a GDP.

6. The ETMS Hubsite updates the ADL with cancellation messages from the users and forwards the updated ADL to all requesting FSMs at the next 5-minute update interval.

7. The ATCSCC TMS views the updated ADL and once again models the program to determine whether a GDP is still needed and to confirm if the proposed parameters are still the best alternatives. If a GDP is still needed, the TMS composes an Actual GDP Advisory. FSM (at the ATCSCC) forwards the actual GDP parameters to ETMS for Hubsite processing. As part of the advisory, the FSM Autosend function sends the Estimated Departure Control Times (EDCTs) and/or the Fuel Advisories (FAs) to the ETMS Hubsite, ARTCCs, and/or airlines.

8. The ETMS Hubsite updates the ADL with the actual GDP and forwards the updated ADL immediately to all requesting FSMs. Subsequent ADLs are sent at the regular 5- minute update interval.

9. The ATCSCC TMS uses ETMS Email from TSD to issue the actual GDP advisory. The actual GDP advisory is forwarded to TSD/CCSD users.

10. The OIS Summary page of the ATCSCC Intranet website is automatically updated with the GDP Advisory.

11. TMSs/TMCs record the GDP initiative in the ETMS Log/TMLog and/or local Log tool. The reason for the initiative, the different options explored for the GDP program, the program AAR, anticipated delays, and the ARTCCs included in the program are included in the Log.

12. The ATCSCC TMS generates a Slot List via FSM. The Slot List lists by airline, the flights, assigned slot time, Controlled Time of Departure (CTD), Controlled Time of Arrival (CTA), Earliest Runway Time of Arrival (ERTA), and Initial Gate Time of Departure (IGTD). The flight's assigned slot time is based on the original scheduled (OAG) time, rather than the current estimated time of arrival.

13. The Slot List is forwarded to all applicable TMUs and users.

14. TRACON/ATCT TMCs disseminate GDP information to Controllers using a GI Message via a KVDT or DSR to Host.

15. Users view the updated ADL and Slot List and submit substitution (FM) and/or cancellation (FX) messages as needed. The substitution process allows each airline to use the slots allocated to them in a manner that best meets their individual business needs. The airlines must make all substitutions by a given 'Respond By' time.

16. ETMS updates the ADL with information from the substitution/cancellation messages and forwards the updated ADL to all requesting FSMs at the next 5-minute update interval.

17. ETMS issues a CT (Control Times) message for flights affected by the GDP to the departure Center's Host one hour prior to coordination time. The CT message tells Host to print the estimated departure control time on the flight strip, thus notifying the departure controller that the flight is delayed. If a flight plan is received less than 60 minutes prior to the coordination time, the CT is sent immediately.

18. Host forwards the CT messages to the Tower's Flight Data Input Output (FDIO).

19. The controller at the ATCT receives the CT message via FDIO. The controller issues a clearance to the flight to depart. The aircraft may depart from 5 minutes before, to 5 minutes after, the EDCT (also written as EDCT +-5) to remain in compliance with the control time.

20. During a GDP, the ATCSCC TMS periodically run compression to minimize the number of unused slots.

21. During a GDP, the ATCSCC TMS monitors the progress of the program to ensure the program is affecting NAS operations in the intended manner. The TMS performs the following activities to monitor a GDP:

- Obtain and record the actual IFR arrival and departure counts per hour from AT facilities
- Obtain and record active runways for arrivals and departures reported by AT facilities.
- Obtain and record arrival, departure, and enroute delays encountered by TRACONs, ATCTs, and ARTCCs.
- Obtain and record METAR and special weather observations for each hour of GDP.

22. The TMS can use the Near Real Time FSA tool to monitor the progress of a GDP.
23. The ATCSCC TMS uses FSM to monitor capacity demand imbalances at the airports using alarms such as the CTA and CTD Compliance Alarms.
24. During a GDP, the FAA and airlines can use EDCT commands via TSD, TMShell, or FSM to extract GDP data from the ETMS database, manually update data, and control GDP processing as needed.
25. The TMS uses the TSD to monitor flow patterns, obtain estimated arrival counts, or obtain airborne delay estimates.
26. During a GDP, the ATCSCC TMS may revise or extend the GDP. For example, the weather may improve, so the AAR can be increased. Or the weather doesn't clear up as expected, so the GDP is extended. Or the winds shift causing the runway configuration to change and thus requiring a lower AAR, so the GDP is revised to a new AAR. Before revising a program, the TMS may request an updated ADL for an airport or the latest METAR and TAF for a monitored airport. The GDP may be revised by 1) changing the GDP parameters, 2) increase/reduce delays on flights, or 3) cancel the GDP. Upon changing the GDP parameters, a specialist can model and analyze the new parameters and implement a revised GDP, repeating Steps #7- #19. Increasing/reducing delays on flights (using the FSM +/- Delay feature) causes a fixed number of minutes to be added or subtracted from a flight's delay. Both GDP kinds of revisions, changing the parameters and using the +/- Delay feature, can be modeled and proposed before actually implementing the revisions. An advisory for the GDP revision includes the delays (current or expected), expected length of the continuation of the GDP program, and changes to the list of impacted facilities.
27. The GDP program either runs to completion or is cancelled due to improved conditions. The GDP CNX function allows the specialist to cancel a GDP, releasing all delays (i.e., purging all control times) on flights included in the GDP. New operational parameters and purging of control time are reflected in the next ADL update cycle.
28. When a GDP expires or is cancelled, the ATCSCC must transmit an Advisory stating that the program has expired or has been cancelled as well as update the OIS Summary page on the ATCSCC Intranet website to update the GDP status. The ATCSCC conferences all affected facilities to develop an operational plan to release ground delay traffic into the system.

5.2.5.5 GS Process

Exhibit 5-25. Ground Stop Process depicts Steps #2 through #9 (described below) of a local Ground Stop process.

1. The ATCT may suggest a GS to its associated TRACON / ARTCC due to weather conditions or airport volume, or the ARTCC may initiate a GS due to anticipated imbalance of arrivals / departures at certain fixes / routes. The ARTCC TMC uses FSM to model the GS to obtain the best parameters. The TMC coordinates with airports and sectors within the ARTCC and other ARTCCs affected by a proposed GS with specific delay parameters (start / end time, exemptions, aircraft type, arrival fix, etc.). The ARTCC TMC informs the ATCSCC of a GS.
2. The ATCSCC TMS uses ETMS Email from TSD to issue a GS Advisory. The Advisory is forwarded to TSD / CCSD users.
3. The ATCSCC TMS composes a Ground Stop Advisory using FSM. A specialist can initiate a Proposed Advisory, giving users time to respond to the parameters before implementing the GS. But a ground stop is generally used as a last resort in traffic flow management and is usually enacted immediately. There generally is not enough time to send out a Proposed Advisory and wait for user comments. Thus it is often an Actual Advisory that is sent out. The start time of the GS is current time plus 30 minutes, rounded to the nearest 15-minute interval. GS parameters are forwarded to ETMS for Hubsite processing and to TSD / CCSD users.
4. ETMS updates the ADL with the GS parameters and forwards the updated ADL to all requesting FSMs at the next 5-minute update interval. The ETMS Autosend function sends EDCTs and / or FAs to the ETMS Hubsite and / or airlines.
5. The slot assignments and control times generated for a ground stop are sent to the airlines to advise them of the ground stop. However, the ground stop control times are not sent to the TMUs. CT messages are not generated.
6. The OIS Summary page of the ATCSCC Intranet website is automatically updated with the GS Advisory. If FSM is not used, the ATCSCC TMS must manually enter the advisory data on the OIS Summary page.
7. TMS / TMCs log the GS Advisory. Information about the tier and facility affected by the GS is recorded in the log. The log tools used at the facilities include the ETMS Log, TMLog, or other local tools such as the TMU Log, ‘Blue Log’, etc.
8. ARTCC / TRACON / ATCT TMCs disseminate GS information to controllers via a GI message.
9. The ATCT controller issues clearances to pilots with revised expected departure times.

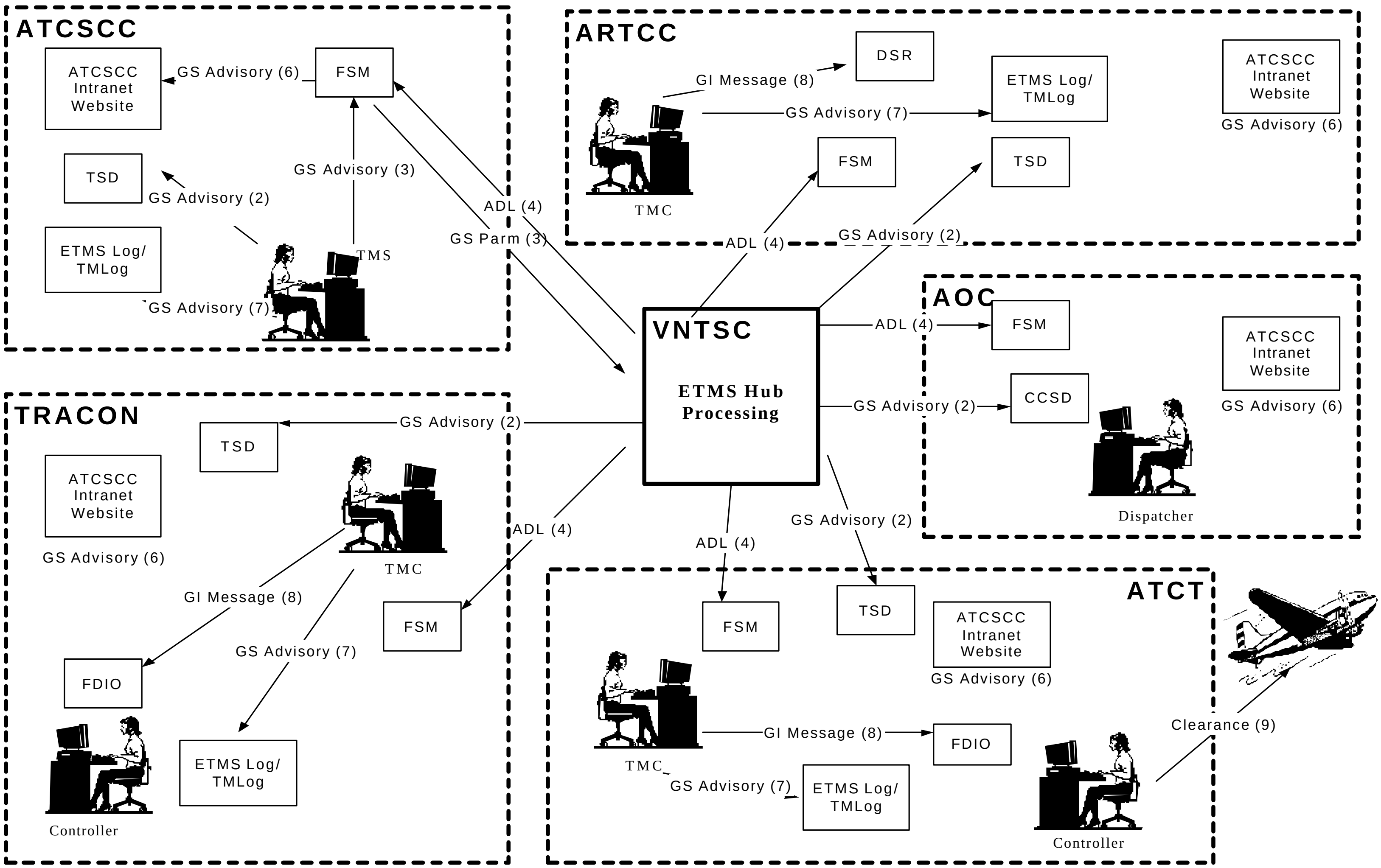

Exhibit 5-25. Ground Stop Process

10. Monitoring GS is similar to monitoring GDP.

11. The GS program either runs to completion or it may be cancelled due to improved conditions. The GS CNX function allows one to cancel a GS, releasing all delays (i.e., purging all control times) on flights included in the GS. Again, changes to parameters and purging of control time are reflected in the next ADL update cycle. When a GS expires or is cancelled, the ATCSCC must update the OIS Summary page at the ATCSCC Intranet website to indicate such status.

5.3 Operational Planning and Analysis

This section discusses three groups of activities that are integral components of the TFM domain:

- Maintaining operational data
- Planning for special government and civilian events
- Performing post event analysis.

Operational data, resident in or being fed to and from TFM systems, is critical to all phases of the TM lifecycle: planning, execution and post analysis. Operational data is acquired, updated, and distributed on a dynamic basis to support situational awareness, provide the data needed for the identification and analysis of emerging issues, and to validate TM decisions. Operational data is archived on a regular basis to provide the data required for post-event analysis and review, policy and process improvement, software testing and incident investigation.

Planning for known special civilian and military / government 'events' is essential part of flow management activities. The activities include identifying the level of added demand the events will place on system components by flights going to and from the event, assessing the demand against available capacities and determine if additional resources are required, and planning how the demand will be handled while still dealing with normal traffic patterns and levels. Following this analysis and planning stage, the resulting action plan is advertised to those who wish to participate in the event. Civilian 'events' covered in this section include both itinerant, short term 'events' (dealt with by STMP reservations) and ongoing congestion issues such as those surrounding very busy (HDTA) airports like New York and Washington, DC (dealt with using CVRS reservations). The Government Events section addresses the processes employed for receiving, disseminating, and supporting air traffic reservations for U.S. government agencies, both military and non-military. The use of ALTRVs and SUAs, as well how VIP movements are handled differently from normal traffic are covered.

The post-event analysis section discussion focuses on the processes and tools used to evaluate program effectiveness after the fact, at both the national and remote site levels. This is broken down into analysis performed for various reasons including system impact assessment, performance analysis, and incident investigation. In addition, this discussion includes an overview of quality assurance tasks performed by Volpe for CDM purposes.

These discussions are covered in this section under the following subsections:

- Section 5.3.1, Maintain Operational Data
- Section 5.3.2, Plan for Special Government Events
- Section 5.3.3, Plan for Special Civilian Events
- Section 5.3.4, Analyze TM Initiative Effectiveness.

5.3.1 Maintain Operational Data

This section describes the activities / processes associated with maintaining the TFM operational data. Operational data maintenance includes the acquisition, updating, distribution, archival, and recovery of operational data. Data acquisition, updating, and distribution are part of the planning phase of traffic flow management, supporting the prediction of excess demand and flow constraint conditions. Data archival and recovery are ongoing support activities provided by the support staff at the Hubsite and ATCSCC and field sites.

The following discussions are provided:

- Section 5.3.1.1, Operational Data Updating and Distribution
- Section 5.3.1.2, Operational Data Archival
- Section 5.3.1.3, Operational Data Recovery.

Discussion in this section focuses only on national TFM tools that are for operational use. Support tools and local tools are not included in this discussion.

5.3.1.1 Operational Data Updating and Distribution

Exhibit 5-26. ETMS Operational Systems and Input Data depicts the operational tools within the TFM domain and their major input data. The TFM operational tools depicted are:

- ETMS – including Monitor Alert, CCFP, RVR, ETMS Email, ETMS Autosend, TMShell, Delay Manager (DMGR)
- ATCSCC Website Tools – including Operational Information System (OIS), Diversion Recovery Web Page (DRWP), Pathfinder Web Page (PFWP), National Playbook, Route Management Tool (RMT), E-Special Traffic Management Program (e-STMP), E-Computerized Voice Reservation System (e-CVRS)
- Other Tools – including Flight Schedule Monitor (FSM), Departure Spacing Program (DSP), Log tools (ETMS Log / TMLog).

Some of the input data, such as weather data and airline schedules, are periodically entered into the tools while others are dynamically entered, automatically (i.e. flight status from ATC systems) and manually (i.e. runway configuration changes). The update cycle for the input operational data is provided in Exhibit 5-27. Operational Data and Update Cycle.

Note that additional information about these tools and data is also provided in Section 6, TFM Tools and Products.

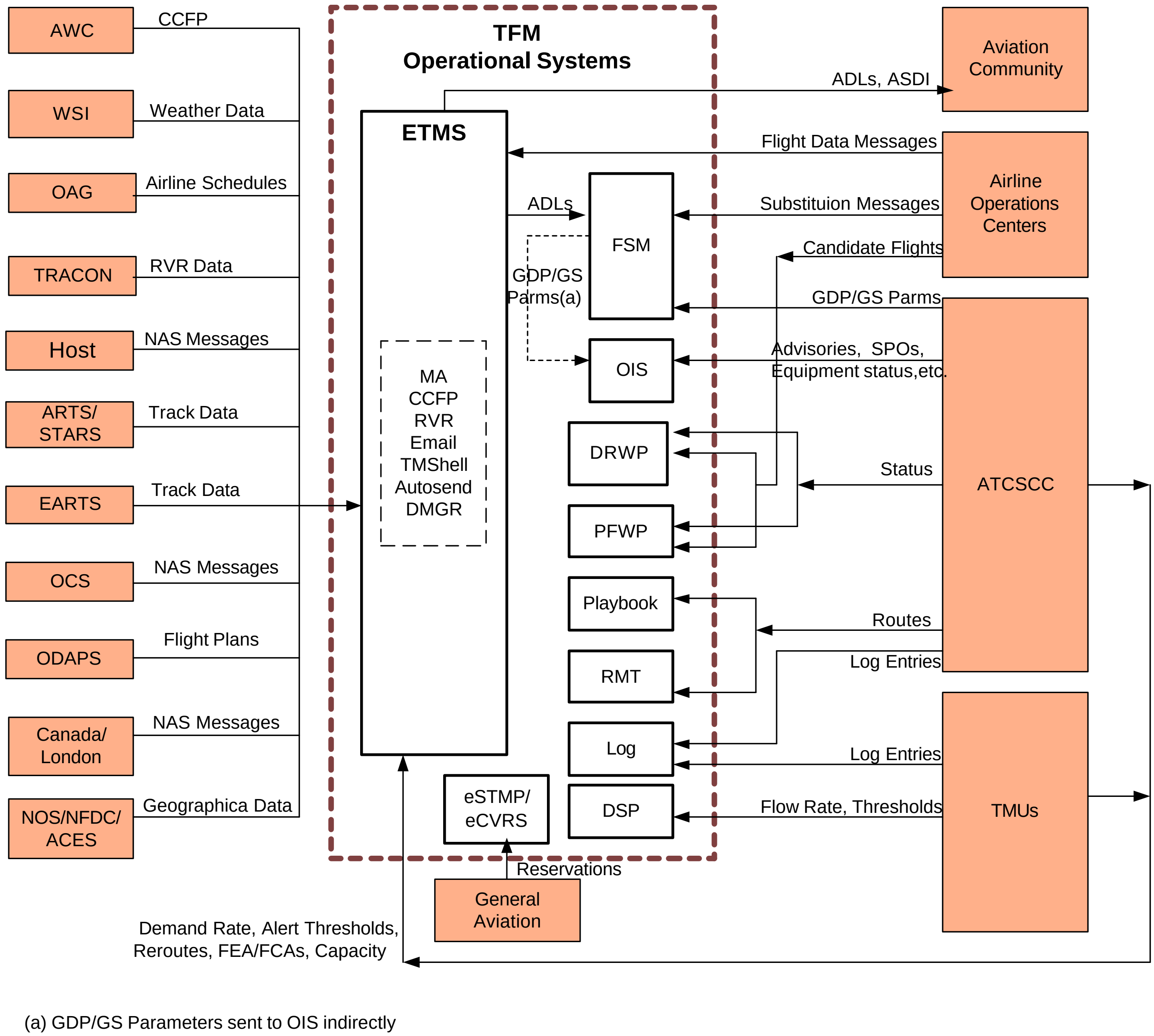

Exhibit 5-26. ETMS Operational Systems and Input Data

The update cycle for the input operational data is provided in Exhibit 5-27. Operational Data and Update Cycle.

Exhibit 5-27. Operational Data and Update Cycle

Operational Systems	Major Input Data	Data Source	Update Cycle
ETMS	Geographical Data – Fixes, Airspaces, Airways, Airports	ACES	Automatic feed every 56 days
	Geographical Data - High altitude airways, Low Altitude Airways, Oceanic airways, DP/STARs, Military training routes	NOS	Automatic feed every 56 days
	Geographical Data - NAVAID guides, Airspace fixes, SUA boundaries, CDRs	NFDC	Automatic feed every 56 days
	Geographical Data - Fixes, Airways, STARS, Restricted Areas in Canada	NavCanada	Automatic feed every 56 days
	Geographical Data - Canadian Airspaces	Canadian ETMS Sites	Automatic feed every 56 days
	METAR/TAF	WSI	Automatic feed every 10 minutes
	Jet Streams	WSI	Automatic feed every 3 hours
	Grid Winds	WSI	Automatic feed every 3 hours
	Radar Tops	WSI	Automatic feed every 10 minutes
	Lightning	WSI	Automatic feed every 5 minutes
	RVR	Airports	Automatic feed every 2 seconds
	CCFP	AWC	Automatic feed every 2 hours
	Airline Schedules	OAG	Automatic feed every 7 days
	NAS Messages	Host, FDP-2000	Automatic feed as available
	NAS–like Messages	Canada, London, Mexico ATCs	Automatic feed as available
	Track Data	ARTS, Micro-EARTS, STARS	Automatic feed as available
	ZNY, ZOA, and ZHN Flight plans	ODAPS, OFDPS	Automatic feed as available
	Airline Flight Data Messages	AOCs	Manually selected/automatic feed from airline processing systems
Operational Information System (OIS)	TM initiatives, SPO, Equipment outages, VIP movements, etc.	ATCSCC	-SPO is manually updated every two hours and refreshed every 1-minute on Intranet & 5 minutes on Internet. -GDP/GS information automatically updated on OIS Summary. -Initiatives, equipment status, & other information are manually updated as needed.

Operational Systems	Major Input Data	Data Source	Update Cycle
Diversion Recovery Web Page (DRWP)	Diversion recovery 'DVRSN' flights	Users	Manually entered as desired when DRWP is active
	Comments/Status	TCA	Manually updated when DRWP is active
Pathfinder Web Page (PFWP)	Pathfinder flights	Users	Manually entered as desired when PFWP is active
	Comments/Status	TCA	Manually updated when PFWP is active
Playbook	SWAP Routes	ATCSCC	Process to update/promote to operational database every 56 days
Route Management Tool (RMT)	Proposed/Validated CDRs	ATCSCC	Process to update/promote to operational database every 56 days
e-STMP / e-CVRS	Slot reservations	General Aviation	Manually entered as desired prior to special events or for high-density airports.
Fight Schedule Monitor (FSM)	ADLs	ETMS Hub Processing	Automatically fed from ETMS every 5 minutes. At beginning of GDP, ADL sent immediately and then updated/sent every 5 minutes after that.
	GDP/GS Parameters	TMS	Manually entered as needed
Departure Spacing Program (DSP)	NAS Z messages	Host	Automatic feed from ARTCCs
	Operational parameters	TMCs	Manually updated as needed
Operational Log	Events/information for the Day	TMSs/TMCs	Manually entered throughout the shift

5.3.1.1.1 ETMS

5.3.1.1.1.1 ETMS Input Data

ETMS Hubsite integrates all inputs to perform its traffic demand and alert processing and traffic management data processing functions. The primary inputs to ETMS are as follows:

- Airline schedules from the Official Airline Guide (OAG) - The airline schedule data files arrive weekly by communication link from the OAG. The OAG file provides ETMS with the planned schedules of all flights arriving, departing, or over-flying the United States, Canada, or England. Each weekly OAG download provides schedules for the next 45 days. A flight's data is loaded into the live ETMS flight database fifteen hours before its scheduled departure.
- NAS Messages generated by various US ATC facilities - The NAS messages provide ETMS with the flight plans and real-time event data (e.g., departures (DZ), arrivals (AZ), position updates (TZ)) from various ATC systems. The main sources for US data are the ARTS at the TRACONs and the Host computers at the ARTCCs. The Host provides flight plan data as well as track updates for flights in en route

airspace. This feed is supplanted by track updates from ARTS for flights in terminal areas. The demand predictions are updated when any of these messages is received.

- Flight plan and arrival messages from the ODAPS in ZNY and ZOA and from the OFDPS in ZHN - The Micro-EARTS in Alaska, San Juan, Honolulu, and Guam send position updates to ETMS as the data becomes available.
- Flight plan, departure, and arrival messages sent by the FDP-2000 (formerly OCS) in Alaska – These are sent in automatically to ETMS as available.
- Message from International ATC Systems (Canadian, British, and Mexican ATC systems) - The Canadian system provides the full NAS message set from its operational centers: Gander, Moncton, Montreal, Toronto, Winnipeg, Edmonton, and Vancouver. The British system provides a partial data set, including flight plans, departure messages, and track updates, from a site in London.
- Weather data from the WSI - ETMS acquires weather data consisting of grid winds reports, current terminal surface observations (METAR/TAF), jet stream information, precipitation radar information, and lightning reports. The grid winds are used to compute flight times; the terminal weather reports, precipitation, jet streams, radar tops, and lightning are used for display purposes. The weather data is fed periodically.
- Geographical data from ACES, NOS, and the NFDC - ETMS uses geographical data to produce graphic displays (maps database) and for internal data processing (grid database). This includes boundaries, sectors, ARTCC boundaries, TRACONs, airways, fixes, NAVAIDs, airports, and SUA or Military areas. ACE, NOS, and NFDC produce geographical data files every 56 days.
- Flight data messages generated by airline flight data systems - The airline flight data messages provide ETMS with real-time schedule updates – cancels, delays, and new flight legs that occur during daily flight operations. Airlines generate VHF position update messages, which are received by ETMS over the ARINC network. Airlines also submit substitution messages assigning flights to slots during GDPs. When these schedule updates are received at the Volpe Hubsite, they are incorporated into the ETMS flight databases to produce the Aggregate Demand List (ADL), which is used by the Flight Schedule Monitor (FSM) and ATCSCC/CDM participants to monitor and predict future airport demand.
- RVR data from airports – RVR values measuring airport visibility, ambient light, and runway light intensity at runway touchdown point, midpoint, and rollout points reported to ETMS every two seconds. This RVR data can be viewed by specialists, airlines, and the public at the FAA internet site, by authorized users on the Volpe CDM DataGate website, as well as on the TSD using the WX Request function. Primary input comes from RVR sensor data from the airports.
- Traffic demands, capacity, and alert threshold definitions from TMS - ETMS uses these definitions for traffic modeling and alert functions. Nominal alert thresholds are input to ETMS through manually maintained files, but alert thresholds can be changed manually by authorized traffic managers via the TSD.

- FEAs/FCAs and reroutes - TMSs/TMCs define and share FEAs/FCAs so affected facilities can assess the impact to flights traversing and/or expected to traverse a severe weather or congested area. These FEA/FCA definitions are entered manually as needed on the TSD. Reroute definitions are submitted by TMSs/TMCs to be shared with other TMUs.

5.3.1.1.1.2 ETMS Data Updating

The major operational databases in ETMS and the maintenance of their contents are described in the ETMS Functional Description Document. Summaries of the content and updating of these databases are as follows:

- Schedule Database (SDB) consists of airline schedules for one month. This database is structured to provide fast look-up of airline schedules by both airport and time. This database is updated every week with data from OAG along with historical flight path data. The ARTCCs also use a batch process to add scheduled flights that are not in the OAG to this database. TMSs can update this schedule database using four types of transaction commands (Inhibit, Activate, Add/Edit, and Cancel flight) via the TSD. Section 4 of above referenced document describes the maintenance process.
- Flight Database (FDB) is a 'live' flight database of all flight information for up to 12 hours in the past and 15 hours in the future. Sources of the flight information in the FDB are: SDB, real-time airline flight data feeds, and various ATC systems including Host, FDP-2000 (formerly OCS), Micro-EARTS, ODAPS, OFDPS, ARTS, and systems from Canada/Great Britain/Mexico. ETMS handles about 20 types of flight data messages (including flight creation, modification, cancellation, reinstatements, etc.) that are received in any combination and sequence. The flight information provides special snapshots of predicted airport demands as well as input to ETMS Monitor Alert function to predict traffic demands and generate alerts. Updates to this database are dynamic as flights are created, modified, and cancelled by the airlines and as flights change status by the various ATC systems. The description and updating of the FDB is described in Section 5 of the above ETMS manual.
- Traffic Demand Database (TDB) contains traffic demand count and alert threshold for each element, each event type, and each 15-minute interval. The monitored elements are:
    - Airport – the numbers of arrivals and departures per 15-minute interval
    - Sector – the number of aircraft in the sector at the peak minute during each 15-minute interval
    - Fix – the number of flights crossing the fix in each 15-minute interval.

  The monitored elements are specified in a manually maintained list. Anytime there is an update to the Flight Database (FDB), i.e. flight added, departed, cancelled, etc., the corresponding update is made to the Traffic Demand Database to maintain an accurate traffic count and to generate the relevant alerts. There are two sets of alert thresholds for each element, event type, and 15-minute interval: the nominal threshold and today's threshold. The nominal thresholds are a set of default values, stored on a manually maintained data file and read into the TDB. The nominal thresholds initially set today's values, but can be changed by authorized traffic managers to check today's traffic demands and generate alerts. Details of the traffic demand and alert processing are described in Section 8 of the ETMS document.

- Alert Summaries Database contains alert summary files that consist of demand counts for alerted elements as well as capacity values for all alerted airports, sectors, and fixes. This database is updated whenever ETMS generates an alert update every minute. The update contains the data for all alerted elements and for specified airports and sectors whether they are alerted or not. The alert updates are used to generate the Monitor Alert Summary and the Monitor Alert time line and bar chart displays on the TSD.
- Traffic Management Database includes GDP/GS parameters, EDCTs, controlled departure times from slot lists and subs, and FA delays.
- Reroute/FEA/FCA Database contains FEA/FCA definitions including the volume of airspace for the FEA/FCA, the criteria for filtering the flights that are predicted to intersect the FEA/FCA, and the time period for the FEA/FCA (which must end within the next 15 hours). The database also contains the reroutes (public, local, and private) that have been created by the TMSs/TMCs. These reroutes can be created using the CDRs that are maintained at the ATCSCC. The database is updated as reroutes and FEAs/FCAs are defined.
- Weather Data is used to generate weather (radar-determined precipitation data, jet stream, radar tops, lightning, and CCFP) overlays and weather reports. METAR/TAF data is maintained in encoded form as provided by WSI. The METAR/TAF data is fed automatically from WSI every 10 minutes. When a report is requested, ETMS retrieves latest terminal forecast and surface observations received for that airport and combines and formats a single report using standard weather terminology.

5.3.1.1.1.3 ETMS Internal Data Distribution

ETMS data resides in three places: the traffic manager's workstation, the file server at the traffic manager's site, and the ETMS Hubsite. The only ETMS data stored directly on the traffic manager's workstation is the map overlay data. The flight data used to generate the traffic situation updates is stored on the file server at each site, as are the alert summary data and some of the weather data (all except METAR/TAF reports). All other data accessible through the ETMS user interface processes is stored on nodes at the Hubsite. The CDR and Playbook databases reside at the ATCSCC.

Residing at the Hubsite are the following databases:

- Weather -METAR/TAF reports and Grid Winds data
- Traffic Demands – traffic demands for each element type
- Traffic Management – GDP/GS data

- Airline Schedules – schedules from OAG
- Reroutes and FEA / FCAs – reroute and FEA / FCA definitions.

Residing at the site fileserver are the following:

- Weather - jet stream, precipitation, lightning, radar tops, CCFP
- Flight Data – individual flight data from flight data transactions sent from the Hubsite
- Alert Summaries – summary demand and capacity values for all alerted airports, sectors, and fixes
- Reroutes and FEA / FCAs – reroute and FEA / FCA definitions.

Residing at each site workstation are the following:

- TSD Static Data Files – maps, fixes, airports, and other display overlay information.

Note that data on the traffic manager's workstation can be accessed most quickly, since no communication is required (i.e., data is on a disk or in physical memory) whereas data on the file server at the site cannot be accessed as quickly for two reasons: the data must be communicated over the LAN and the file server may be busy performing other functions. Data access from the Hubsite is generally slowest, because the data must be communicated over landlines or satellite links, which operate at much slower speeds than a LAN.

Exhibit 5-28. ETMS Data Distribution depicts the distribution of operational data from the Hubsite to the field site file servers and to the field site workstation.

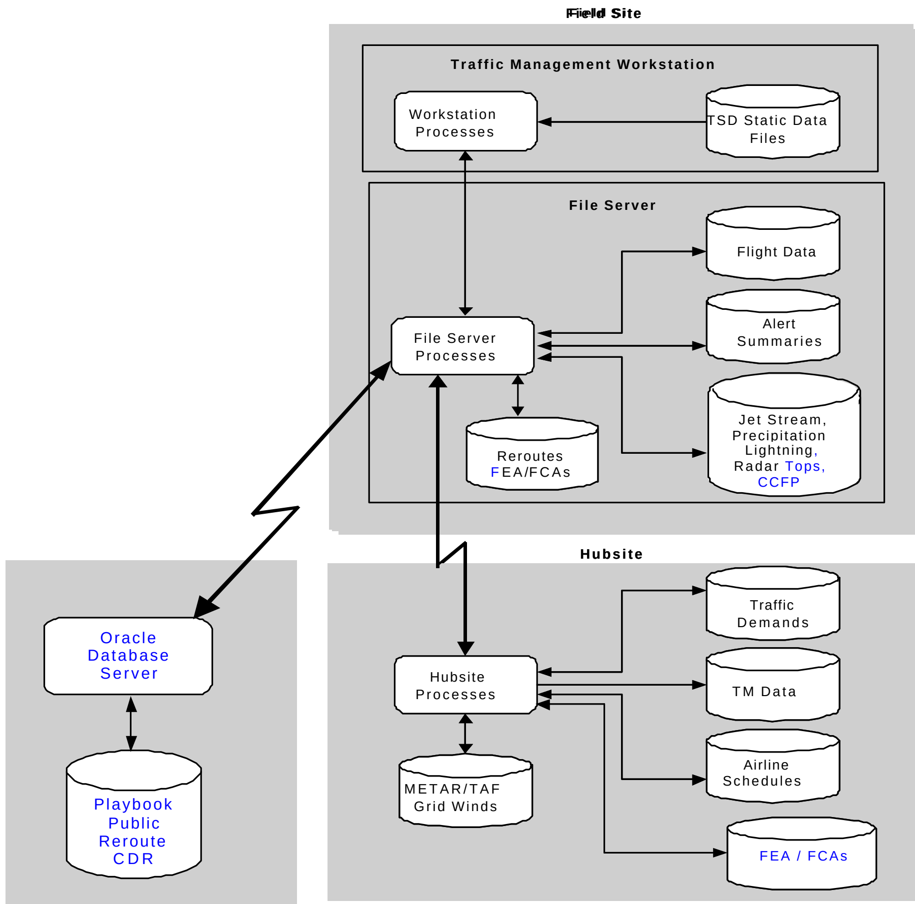

Exhibit 5-28. ETMS Data Distribution

5.3.1.1.1.3.1 Hubsite to Field Site Data Distribution

The Hubsite transmits flight data to the field-site file server by means of *flight transaction messages*. The various types of flight transaction messages include position, route, time, block/altitude, position update (TZ), cancel, total traffic management (TTM), and critical messages. The last two types, TTM and critical, are used for data recovery. Other data that are sent automatically from Hubsite to a field site include reroute and FEA/FCA data transactions, alert summaries, and weather data.

5.3.1.1.1.3.2 Field Site File Server to Workstation Data Distribution

Updates to traffic situation, alert, weather, reroute, and FEA/FCA data are automatically distributed from the field site file server to the site's ETMS workstations. The traffic situation data and the alert data are updated every minute. The workstation's Data And Communications Server (DACS) function polls the weather directories on the local server for the latest weather files continuously. Updates to the site file server's reroute and FEA/FCA database are broadcasted to all the TSDs at a site.

5.3.1.1.1.4 ETMS External Data Distribution

The main data distributed by ETMS are the ADLs and ASDI.

5.3.1.1.1.4.1 Aggregate Demand List (ADL)

The combined data in the Flight Database (FDB) is distributed to CDM participants by ETMS in data files called Aggregate Demand List (ADL). Each ADL contains the flight records for all flights anticipated to arrive at a particular airport within a 21-hour time frame (from one hour earlier to twenty hours later than the current time). Departure data is also available in the ADL. The ADLs are distributed via the CDMNet.

See Section 6.2.2, Aggregate Demand List (ADL), for more information.

5.3.1.1.1.4.2 Aircraft Situation Display to Industry (ASDI)

ASDI is NAS data collected at ETMS Hubsite that is made available to the aviation community. This is a flow of raw NAS messages from ETMS that is provided to private enterprise to provide the software to display, monitor, and analyze the data. The ASDI feed includes NAS messages received by ETMS, oceanic position update (TO) messages generated by ETMS, and route (RT) messages generated by ETMS. The data is filtered prior to sending to aviation community. Sensitive and military messages and messages from certain facilities are filtered.

See also Section 6.2.3, ASDI, for more information.

5.3.1.1.2 Operational Information System (OIS)

OIS is an integrated information display and distribution system for critical and rapidly changing traffic management information. This is accessible from the ATCSCC Intranet Website. Information provided on OIS includes the Summary Page which lists all initiatives in effect at various airports, East and West Directory, Planning Team, Severe Weather, Tier Information, etc. Most of the information on the OIS is manually entered and updated by TMSs. Some information is automatically fed into OIS, such as the GDP/GS advisory information from FSM when a GDP/GS program is initiated.

Distribution/access to information from the ATCSCC Internet and Intranet sites - Access is dependent on one's authorization to the sites. General public has access only to the Internet site. CDM participants have read/write access to the CDM tools on the Intranet such as CCSD, Diversion Recovery, and Pathfinder Web Pages. TMSs/TMCs/ATs have read/write access to the Intranet site depending on their positions. See Section 6, Tools and Products, for specific detail about access to tools at the ATCSCC websites

5.3.1.1.3 Diversion Recovery Web Page (DRWP)

DRWP is a website providing FAA and users an automated, real-time, interactive traffic management decision support system for identifying, monitoring, and tracking diverted flights through their recovery process. Inputs to this website come from airline users when they denote certain flights as 'DVRSN' flights and/or request for special handling of those flights. The DRWP is activated, monitored, and deactivated by the TCA.

5.3.1.1.4 Pathfinder Web Page (PFWP)

PFWP is a website providing users a way to inform FAA about their capability and interest to have certain flights be pathfinder flights. Inputs and updates to this ATCSCC Intranet website come from the users when they wish to add/delete candidate pathfinder flights and from the TCA. The TCA activates, monitors, updates, and deactivates the PFWP. Users are notified when pathfinder event is over.

5.3.1.1.5 National Playbook

National Playbook is a collection of Severe Weather Avoidance Plan (SWAP) routes that have been pre-validated and coordinated with impacted ARTCCs. Activation and deactivation of the National Playbook route usage is notified via the ATCSCC Intranet Website and Advisory messages. The routes on the Playbook are described textually and graphically including the resource or flow impacted, facilities included, and specific routes for each facility involved and preferential and alternative routes to major destinations from the designated routes. The TMUs and airlines have read access to the Playbook from the ATCSCC Intranet websites and the public has read access from the Internet website. ATCSCC manages the National Playbook program and is responsible for any changes to the Playbook routes. Updates to the Playbook coincide with the normal 56-day chart updates. Playbook routes may be modified tactically if necessary. The ATCSCC Severe Weather Unit coordinates such changes verbally with impacted facilities and ensures that the published advisory contains the modifications.

5.3.1.1.6 Route Management Tool (RMT)

RMT is a query tool providing ATCSCC, ARTCC and users easy access and graphical displays of Coded Departure Routes (CDRs). The RMT CDR database can be viewed and downloaded from the ATCSCC Internet and Intranet websites as well as read/updated from PCs at the ATCSCC and ARTCCs. Primary input to RMT are proposed and validated route definitions submitted by TMUs at ARTCCs and NavCanada.

Coded Departure Routes are modified on a fifty-six (56) day cycle. The first twenty-one (21) days are the Active Period where routes can be added, deleted, or modified (by ARTCC administrators in a CDR staging database). The following five (5) days are the Verification Period where all changes are validated by the ATCSCC and ATA-100. The remaining time in the cycle (30 days) is the Quiet Period, which allows Centers and airlines to download or update their own files preparing for operational use of the new set of routes. User permissions during the various periods are as follows:

- ATCSCC users have access to all routes and modifications in the staging and operational databases.
- ARTCC users have access to all routes and modifications in the staging and operational databases.
- Airline users have view-only access to both the staging and operational databases.
- Internet users have view-only access to the operational databases.

5.3.1.1.7 E-Special Traffic Management Programs (e-STMP)/ E-Computerized Voice Reservation System (e-CVRS)

e-STMP is a web-based application allowing general aviation to request, confirm, update, and cancel a reservation to and from an airport for a specific special event. All e-STMP user entries are manually entered, providing information about the users' intent for arrival/departure from an airport for a special event. e-CVRS is a web-based application allowing pilots of non-scheduled IFR flights to make reservations to enter/depart from High Density Traffic Airports (HDTA) including JFK, DCA, and LGA. The reservations are for year round use, not just for special events as is the case for e-STMP. Both can be accessed from the FAA Internet site.

5.3.1.1.8 Flight Schedule Monitor (FSM)

FSM allows the FAA and users to monitor traffic demand. ATCSCC use FSM to model and implement Ground Delay and Ground Stop Programs. The primary inputs to FSM are the ADL files generated every 5 minutes from ETMS. One ADL is generated for each registered airport and ADL files currently cover a 20-hour period from one before the current hour to nineteen hours after the current hours. The ADL files that ATCSCC FSM gets contain all the aircraft Ids while the ADL files that the AOC FSMs get are such that the aircraft IDs of aircrafts from general aviation, military, and other carriers are disguised. FSM gets all the data for its displays and to compute GDPs from the ADL files. Ground delay program and ground stop parameters (including the updated AAR/ADRs) entered on the GDP/GS cover sheet by the TMSs are transmitted to the ETMS flight modeling function where they are used to revise the flight information for all affected flights.

5.3.1.1.9 Departure Spacing Program (DSP)

DSP evaluates aircraft departure flight plans at participating airports, models projected aircraft demand at departure resources such as first and second departure fixes, and provides windows of departure times to controllers. Primary input data and updates to DSP are:

- NAS Z messages (i.e. FZ, DZ, etc.)
- Operational parameters such as current airport configuration parameter, airport priority, airport demand parameter, runway departure rate and fix flow rate for each DSP-adapted fix

The NAS Z messages are automatically fed into DSP from Host. The DSP Database Management (DBMS) function maintains a complete list of departure schedules, flight information, and DSP airport information for the entire ARTCC. The database of current departure schedules for each DSP Tower is dynamically updated as flight departure information is modified. Airport, aircraft, and fix information, which are typically geographic and site-specific adaptation data, are collected from each site and must be downloaded to each of the adapted DSP Towers and to the DSP Scheduler before DSP system is started up. The DBMS function also maintains operational parameters that are dynamically modified as needed within a specified range according to operational needs.

A common DSP display used at the sites is the Airport Lineup display that provides a flight departure lineup at each airport as well as airport configuration information. This display is updated whenever flight plan data changes.

5.3.1.1.10 Operational Logs (ETMS Log/TMLog)

TMUs use the ETMS Log, TMLog, and/or other local log tools to record their daily activities. TMSs/TMCs open their position logs at beginning of their shifts and close their logs at close of the shifts. Log entries contain data describing events of the day. Information manually recorded throughout one's shift include:

- Runway configurations and associated AAR/ADR
- Weather information
- Outages that may cause delays
- Initiatives
- Reroutes
- Coordination activities
- Shift summary.

Some Log entries are automatically created. When the TMS create a SPO entry in the OIS, an entry is automatically created at the TMS' workstation log with that entry.

TMLog allow the sharing of log information among all facilities over the ETMS national network. Log information is usually archived for references and later analysis.

5.3.1.2 Operational Data Archival

Data archival in the TFM system is not for recovery purposes, but for post analysis and software testing purposes. Archival of operational data is performed at the Hubsite, ATCSCC, and field sites.

5.3.1.2.1 Data Archival at Hubsite

The following data files are archived at Volpe:

- Advisories and other messages sent to the airlines.
- NAS messages from FAA ATC systems (Host, ARTS, ODAPS, etc.).
- Substitution messages from airlines.
- ASDI feed (with and without London data).
- Processed weather data including echo tops, lightning, NOWRAD, jet stream, winds aloft, METAR/TAF and CCFP.
- Flight data for each active flight. Route data for each active flight.
- Traffic demand counts for each element and alert thresholds.
- Log of EDCT events.
- Fuel advisory, GDP parameters, slot lists, messages from airlines.
- Diversion Recovery Accumulator and Forwarder event logs and Accumulator data files.

Data archival is run automatically via scripts at the beginning of each hour. The data is archived to tape with each tape containing data for each 24-hour period. The tapes are loaded and unloaded manually by the Volpe ETMS support staff whenever an alarm is received at end of each 24-hour period. Failure to change the tapes can result in a gap in data being archived.

5.3.1.2.2 Data Archival at ATCSCC

Dynamic data that is generated by ATCSCC and incoming data to ATCSCC are archived using an archive software produced by ATT 220. This configurable archive software simply copies any modified files to storage. The software is run redundantly on two HP C360 machines with each having an external drive array with roughly 65 GIG of space available. This allows ATCSCC to keep approximately 15 days of data, as required of ATCSCC. The data files that are archived including the following:

- Messages sent by each workstation
- Messages received at each workstation
- Reports generated at each workstation
- Log entries at each workstation
- Weather files with lightning, jet stream, echo tops, CCFP, NOWRAD, etc. information
- Messages from NADIN
- Advisories and other messages to airlines
- Ground Delay information.

5.3.1.2.3 Data Archival at Field Sites

Operational data at each TMC workstation including the Log files are archived at each field site. Additional data may be archived and the processes used to archive the data vary from one site to another.

5.3.1.3 Operational Data Recovery

Data recovery processes are established at the Hubsite, ATCSCC, and field sites.

5.3.1.3.1 Data Recovery at Hubsite

Cross string switch provides the recovery mechanism at Volpe. Cross string switch occurs between the redundant A and B processing strings at Volpe. If one of the redundant processing strings becomes non-functioning, a Volpe support services specialist would initiate a cross string recovery process, which uses the functioning string as the data source to repopulate the databases of the non-functioning string.

See Section 7.2.1, ETMS Hub Disaster Recovery, for more information about cross string recovery process.

5.3.1.3.2 Data Recovery at ATCSCC

Software at all ATCSCC operational workstations is kept identical across all similar systems. So the recovery method is very simple – just copy the software from another similar workstation or from a baseline image. The recovery of the operational data follows the same process as those of other field sites.

5.3.1.3.3 Data Recovery at Field Sites

Situations can arise where the ETMS flight data at a field-site is incomplete. The file server can detect such a situation in two ways. First, when the file server processes are first started up, they may discover that the flight tables are empty or that the flight tables may not have been updated for some time period. Secondly, when the file server provides flight data for a flight list generated at the Hubsite, it may discover that it is missing data for a flight in the list. In either case, the file server will recover missing data from the Hubsite databases.

The file server can request recovery data in three ways:

- A complete recovery is requested when the file server has no flight data.
- A partial recovery is requested when the file server is missing data for a time range.
- A flight data recovery is requested when the file server is missing data for a specific flight or set of flights.

In each case, the Hubsite transmits the requested data. The Hubsite sends the data through the normal flight data transactions that are used to send current flight data.

5.3.2 Plan for Special Government Events

This subsection describes the processes, tools, and data used at both national and local traffic management facilities to receive, disseminate, and support air traffic reservations for U.S. government agencies, both military and non-military (e.g., NASA space launches and re-entries). Altitude Reservations (ALTRVs), Special Use Airspace (SUA), and VIP movements are discussed.

5.3.2.1 Altitude Reservations (ALTRVs)

An ALTRV is required when a number of aircraft (usually military) must be moved with less IFR separation between aircraft than is allowed by standard ATC criteria or when a number of aircraft must operate within prescribed altitudes, times, and/or areas. ALTRVs may encompass rocket, missile, space shuttle, and Remotely Piloted Vehicle (RPV) activities. Aerial refueling, military training, and military formation flights are examples of ALTRV mission flights.

An ALTRV can be moving or stationary. A moving ALTRV means that the path in front of and behind the mission is protected for a short period of time/distance but the airspace can open up behind the missions as soon as the mission moves on. Stationary ALTRVs protect one or more blocks of altitude at specific latitudes/longitudes or intersections along a route for a set period of time. ALTRV missions often make use of published routes such as IFR Military Training Routes (IRs) and VFR Military Training Routes (VRs).

A Mission Project Officer from one of the branches of the U.S. Armed Services (e.g, U.S. Air Force, U.S. Navy) or NASA submits an ALTRV request to reserve a block of airspace for special operations that are not performed in predefined (by adaptation) SUAs reserved for the military. SUAs are discussed in Section 5.3.2.2.

The ALTRV request is submitted to the Central Altitude Reservation Function (CARF) position at the ATCSCC when the mission traverses more than two facilities or penetrates another country’s airspace. The ALTRV request is submitted to the Military Operations Specialist (MOS) at an ARTCC/CERAP when the entire route of flight and associated protected airspace will not involve more than two ARTCC/CERAPs' area of control jurisdiction. To simplify the discussion in the remainder of this section, reference is made only to the CARF specialist. When the ALTRV is submitted to the ARTCC/CERAP, the MOS performs the CARF specialist role.

The ATCSCC CARF specialist ensures that submitted ALTRV requests are not in conflict with one another and do not violate any locally imposed restrictions in the Center airspace they traverse. If a conflict or violation is detected, the CARF specialist works with the interested parties to come to a resolution. The CARF specialist continues to coordinate and monitor the ALTRV mission until it reaches its destination.

Approval of airspace for an ALTRV does not preclude ATC from using that airspace, provided that separation is applied between aircraft within the ALTRV and other aircraft in accordance with *FAA Order 7110.65 Air Traffic Control*.

5.3.2.1.1 ALTRV Classes

There are eight ALTRV precedence classes designed to resolve conflicts among missions. Each class has its own submission-timing requirement. The ALTRV classes and timing requirements are defined in *FAA Order 7610.4J Special Military Operations*, *Chapter 3*, *Section 4*, and are summarized in Exhibit 5-29. ALTRV Precedence Classes and Submission Timing Requirements.

Exhibit 5-29. ALTRV Precedence Classes and Submission Timing Requirements

Class Number	Description	Submission Timing Requirement
1	Aircraft implementing peacetime national emergency plans as well as missile activities authorized by approved and pre-coordinated procedures or letters of agreement. Class 1 is also used for aircraft transporting the U.S. President or Vice President when conducting international flights.	ALTRV APREQ should be filed as far ahead of departure/estimated time of launch as practicable.
2	Aircraft engaged in search and rescue operations.	ALTRV APREQ should be filed as far ahead of takeoff as practicable.
3	Aircraft engaged in emergency air evacuation, hurricane operations, Weather RECON or other operations involving safety of lives or property; i.e., use of airlift forces as directed by appropriate authority in support of domestic crises.	ALTRV APREQ should be filed as far ahead of takeoff as practicable.
4	Deployments at the direction of the Joint Chiefs of Staff (JCS) in support of an exercise or large scale mission and fulfilling an unforeseen requirement. The deployment should be essential to the success of the exercise or mission.	ALTRV APREQ should be filed as far ahead of departure as practicable.
5	Aircraft engaged in important peacetime service, joint or unified/specified command exercises or missions. Notification of application of this priority must be received from the appropriate military headquarters.	ALTRV APREQ shall be filed at least 15 days before proposed takeoff. It may be filed less than 15 days before proposed takeoff with CARF approval.
6	Aircraft engaged in a large-scale mission directed by a major command headquarters.	ALTRV APREQ shall be filed at least 10 days before proposed takeoff.
7	Aircraft engaged in evaluation-type operations or overseas deployment.	ALTRV APREQ shall be filed at least 4 days before proposed takeoff except for ALTRVs penetrating foreign airspace, which requires 6 days.
8	Aircraft engaged in missions directed by specified air forces or commands, aircraft engaged in other training exercises, and all other aircraft requesting ALTRVs.	ALTRV APREQ shall be filed at least 4 days before proposed takeoff except for ALTRVs penetrating foreign airspace, which requires 6 days.

A short-term notice ALTRV request is a request that has not met the specified timing requirements. It is processed as a normal ALTRV request if the CARF specialist's current ALTRV workload can accommodate it.

5.3.2.1.2 ALTRV Processing Steps

The following list summarizes the steps for requesting, approving, and implementing an ALTRV. The role(s) assigned responsibility for performing each step is indicated in parentheses. Each step is discussed in more detail below.

- Request an ALTRV (Mission Project Officer)
- Verify Requested ALTRV Mission is not in Conflict with Other ALTRV Missions (CARF Specialist)
- Verify Requested ALTRV Mission Doesn't Violate Local ARTCC Restrictions (ARTCC MOS)
- Generate Mission Flight Strips at Center(s) (ARTCC MOS)
- Approve ALTRV Request (CARF Specialist)
- Compose and Disseminate ALTRV NOTAM (CARF Specialist, NOTAM Specialist, U.S. NOTAM Office)
- Activate or Reschedule Mission (ARTCC ATC, ARTCC MOS, CARF Specialist)
- Monitor and Control the Mission (ARTCC ATC, ARTCC MOS, CARF Specialist)
- Log Mission and Prepare CARF Mission Envelope (CARF Specialist).

Request an ALTRV. The Mission Project Officer requests an ALTRV from the CARF specialist at the ATCSCC. The request is sent via the Automatic Digital Network (AUTODIN) or, if time is limited, is faxed, phoned, e-mailed, hand-carried, etc. The ALTRV request contains a header including the mission name and ALTRV class and fields A – G, which are defined below:

A. Callsigns for all aircraft that will depart together

B. Number of aircraft, type of aircraft, and equipment suffix

C. Point of departure

D. Route of flight, elapsed times, altitudes for each segment, and events

E. Destination of receivers

F. Departure information - cell identification, date/time, Aircraft Departure Min/Sec in Stream (ADMIS), AVANA (i.e., ALTRV approval Void for Aircraft Not Airborne by (time))

G. Remarks – True Airspeed (TAS); Project Officer's name, grade, and phone number; Alternate Projects Officer's name, grade, and phone number; ARTCC/CERAPs involved; additional information.

Refer to *FAA Order 7610.4J Special Military Operations, Chapter 3, Section 9* for additional details regarding ALTRV content and format. Exhibit 5-30. Example ALTRV Request with Tankers Joining and Leaving the ALTRV En Route provides an example of an ALTRV Request.

ALTRV APREQ BUSY LEADER OSCAR 97-1/6

A. PRO01,04,06 ZESTY51-55

B. 3B52/A 5KC135/A

C. KRME

D. FL280B310 RAVEC GSS 325/025 0007 SYR 042/087 0018 LVLOF BY PLB 281/015 0027 PLB 216/053 0035 PLB 216/096 0041 XPND FL260B310 JOIN
ZESTY56-58 3 KC135 IFPFP KGSB GSS 0049 ARIP CMPS FL260B290 LVLOF W/I 50NM DRCT SYR 273/064 0105 ARCP AIRFL BEGINS FNT 105/105 0137 LEAVE PRO01,04,06 ZESTY 56-58 IFPFP TO KRME
((BR ZESTY51-55 FL260B290 FROM FNT 105/105 0137 CMPS FL280B290 LVLOF W/I 10NM DRCT FNT 112/08242 DJB 288/022 0153 APE 001/043 0159 APE 113/034 0207 HNN 023/041 0213 HNN 0229 ENTER MANEUVER AREA BNDD BY HNN HNN 176/023 HNN 118/045 HNN 086/040 EXIT AT HNN 0229 CMPS FL280 LVLOF W/I 10NM DRCT FLM 177/046 0238 PXV 032/034 0303 CAP 0328 J80 MKC 037/031 0357 LNK 224/059 0426 CLMB FL290 LVLOF W/I 10NM ENTER MANEUVER AREA BNDD BY LNK 224/084 LNK 176/068 LNK 172/044 LNK 237/063 EXIT AT LNK 224/059 0434 OBH 168/025 0442 OMA 064/033 0501 IOW 520 DRCT SBN 253/041 0545 DJB 288/028 0610 ETG 260/010 0635 SYR DRCT GSS 060/017 0709 RME 0729 LAND

E. KRME 0729

F. ETD PRO01 ZESTY51-53 290855 APR 1997 ADMIS MITO
PRO04 ZESTY54-55 290955 ADMIS MITO
PRO06 291055 AVANA 291155

G. TAS: 430KTS CRUISE/390KTS AIRFL/340KTS LOW LEVEL PROJECT OFFICER: MAJ. STEFANZIC DSN 555-5555/COMM 111- 555-1111

ALTERNATE PROJECT OFFICER: CAPT. KARI DSN 555-5556/COMM
111- 555-2222

ADDITIONAL INFORMATION: MARSA ALL BUSY LEADER OSCAR AIRCRAFT.

IFPFP ROUTING FOR PRO01, 04, 06 FROM FNT 105/105: REQ FL350 DRCT CRW PSB GSS 060/017 RME.

ARTCC: ZBW, ZOB, ZDC, ZTL, ZID, ZJX, ZKC, ZMP, ZAU, INFO ZNY

ALTRV APREQ MAPLE FLAG DEPLOY 97/4

A. LION1-6

B. 6F15/R

C. KVPS

D. FL270B290 RAVEC CEW 009/024 0007 J39 LVLOF BY MGM 0014 J39 VUZ 0025 VUZ 333/121 0039 ARIP FAM 134/067 0054 ARCP JOIN NORGE99 KC135 IFPFP FROM KIAB AIRFL DRCT FAM 0104 LMN 0139 AIRFL ENDS LEAVE NORGE99 IFPFP TO KIAB FSD 0205 J45 FSD 319/020 0207 ARIP FSD 319/060 0213 ARCP JOIN INSET 34 KC135 IFPFP FROM KRDR AIRFL DRCT ABR 0222 MOT 0252 4900N 10220W 0300 ENCAN 4940N 10315W (MOT 304/061) 0314 AIRFL ENDS LEAVE INSET 34 IFPFP TO KRDR CLMB FL330 LVLOF W/I 20NM DRCT VLN 0348 UOD 0355

E. CYOD

F. ETD: 111750 MAY 1997 ADMIS 20 SEC AVANA 111850

G. TAS: 420KTS AIRFL/510KTS CRUISE

PROJECT OFFICER: MAJ TRACY

DSN 904-4426, COMM 703-904-4426

ALTERNATE PROJECT OFFICER:

CAPT KELLY DSN 904-4400, COMM 703-904-4427

ARTCCS CONCERNED: ZJX ZTL ZME ZKC ZMP ARU ADDITIONAL INFORMATION: MARSA ALL MAPLE FLAG DPLY ACFT ENTIRE MISSION. ALL ACFT MNPS CERTIFIED.

IFPFP RTG FOR INSET34 FROM 4940N 10315W REQ CLMB FL390 DRCT FIX.. FIX.. FIX.. FIX

Exhibit 5-30. Example ALTRV Request with Tankers Joining and Leaving the ALTRV En Route

Verify Requested ALTRV Mission is not in Conflict with Other ALTRV Missions. The CARF specialist enters the ALTRV details into the CARF computer that is supplied by the DOD, and the CARF program checks the requested route to ensure that there are no conflicts with existing CARF missions. The CARF program is able to tabulate crossing tracks, altitude separation and time difference between missions. See Section 5.3.2.1.5 CARF Computer for additional information. If the CARF computer is unavailable or if the mission is classified, the CARF specialist plots the missions manually on clear plastic overlays that can be rolled up and stored in a secure place.

If there is a conflict with one or more previously filed ALTRVs, the CARF specialist works with the affected Mission Project Officers to resolve the conflict. When resolving conflicts, missions with higher precedence are given priority over lower class missions. The following solutions may also be applied: adjust timing by changing the Estimated Time of Departure (ETD) or the AVANA time, adjust the altitude on the mission nearest to its destination, and/or change routing.

Verify Requested ALTRV Mission Doesn't Violate Local ARTCC Restrictions. If there are no mission conflicts, the CARF specialist sends an ALTRV message, via the CARF computer over the NADIN or Service B interface, to the Military Operations Specialist (MOS) in the affected centers to verify that the requested route does not violate any locally defined Military Operations Area (MOA) or Letters of Agreement (LOA). If the ALTRV request is for a mission that departs from a point within the U.S. and penetrates another country's airspace, the CARF specialist coordinates with the appropriate international altitude reservation facility such as the Canadian Altitude Reservation Unit (CARU).

Depending on the complexity of the route, the MOS at the affected centers may either use practical experience or manually generated plots to confirm that the requested ALTRV route does not violate any local MOAs/LOAs. Manually generated plots of the requested route make use of a preprinted, detailed map template of the facility airspace so that the mission location is depicted in the context of the local facility airspace. The TFM Functional Audit Team observed the use of manually generated plots at Chicago Center.

If there is an MOA/LOA violation, the MOS determines an alternate route using either practical experience or the TSD Reroute function. The MOS proposes the alternate route to the CARF specialist who, in turn, contacts the Project Officer responsible for the mission. The Project Officer either accepts or rejects the alternative. If the alternative route is accepted, the CARF specialist restarts the process by checking the revised ALTRV request through the CARF computer. If rejected, the ALTRV request is denied.

Note that the MOS communicates back to the CARF specialist at the ATCSCC only if there is a problem with the ALTRV request.

A similar process is used for handling international conflicts.

Generate Mission Flight Strips at Center(s). If the ALTRV request is acceptable to the MOS, the MOS generates flight strips for the mission by submitting an Mission Flight Plan (MP) message to the Host Computer System (HCS) through the KVDT. Refer to NAS-MD-311 for a detailed description of the MP message. The HCS converts the route, prints the requested number of flight strips, and deletes the MP message from the system.

The MOS retains the flight strips for later distribution to the affected controllers when the mission becomes active. No other record of the ALTRV mission is retained electronically, and flight strips are not distributed outside of the facility. Distribution of the flight strips signifies that the control center agrees to provide separation during the time of the altitude reservation. At the ZAU facility, the MOS hand delivers the strips to the affected sector controllers about 3 hours prior to when the mission is expected to enter facility airspace.

Approve ALTRV Request. The CARF specialist forwards an ALTRV approval to all concerned parties (e.g., Project Officer, affected ARTCC/CERAPs) at least 24 hours prior to the proposed departure time, unless a shorter time is coordinated with all concerned ATC facilities. The CARF specialist advises all concerned facilities of any corrections or changes to the original ATLRV request. If the ALTRV is cancelled, the CARF specialist disseminates the cancellation to the same parties.

The CARF specialist communicates all information concerning missile launches that may impact the NAS to the NOM.

Compose and Disseminate ALTRV NOTAM. The CARF specialist composes a NOTAM for ALTRV missions that are not specified as “Secure Handling” (i.e., Confidential, Secret, Top Secret) or as “No-Notice” missions. The NOTAM describes the ALTRV area and provides the duration of the ALTRV. Reference is not made to the type of activity within the ALTRV unless the originator has agreed to the publication of this information. The CARF specialist provides the NOTAM to the NOTAM position at the ATCSCC where it is forwarded to the US NOTAM Office (USNOF) for further distribution. For missile shots, ALTRV NOTAMs are issued a minimum of 3 days in advance of the launch time. Exhibit 5-31. provides an example of an ALTRV NOTAM.

Activate or Reschedule Mission. Controllers have the right to refuse an ALTRV mission, even if it has been previously approved, up to the final planning stages of the mission (i.e., before the mission aircraft depart) due to prevailing traffic or weather conditions that affect the safety of either civilian or mission traffic. This option is rarely exercised for approved ALTRV missions, but it can and does happen occasionally.

ALTRV aircraft must depart within the assigned AVANA time for the purpose of providing separation between altitude reservations. Normal AVANA is 1 hour. If a mission is delayed beyond the AVANA time, rescheduling will normally be in 24-hour increments after the original schedule.

```
&FFF KZDCZRZX
200155 KZJXZRZX
ZJX002 GNV

KDZZNAXX - REQ YOU ISSUE FLWG NOTAM WITH INTL DISTRBN
FLIGHT SERVICE STATIONS - RELAY TO TIE-IN BASOPS
INCLUDE THE FOLLOWING IN PILOT BRIEFINGS AS APPROPRIATE:

STATIONARY ALTITUDE RESERVATIONS THAT ENCOMPASS OFFSHORE
ATLANTIC ROUTES ARE SCHEDULED AS FOLLOWS:


TAILHOOK A:
AR3 AND AR4 ARE AFFECTED BY THE ALTRV BGNG 3351/7806 TO
3351/7758 TO 3332/7730 TO 3310/7731 TO 3220/7720 TO
3217/7700 TO 3140/7700 3200/7815 TO 3255/7804 TO POINT
OF BGNG.
FROM 0209211800-0209212000
ALTITUDE SFC THRU 100
```

Exhibit 5-31. Example ALTRV NOTAM

Monitor and Control the Mission. Although the ARTCC has the final responsibility for the separation of mission aircraft, the CARF specialist monitors the ALTRV mission on the TSD until it has reached its target destination and intervenes if necessary to coordinate any needed adjustments. An airborne adjustment may be needed in the following circumstances:

- Mission is not meeting its scheduled times over a fix. The ARTCC has the option of canceling the ALTRV in this circumstance. If the delay is due to natural causes, the CARF specialist may request the involved center(s) to revise the mission times.
- Mission is being diverted to another airport. The CARF specialist contacts the Mission Project Officer to determine if the mission should be canceled or if a new ALTRV should be developed starting from the diverting airport.
- Pilot is not complying with altitudes or the route profiled in the ALTRV approval. The CARF specialist advises the ARTCC that it has the option of canceling the ALTRV and filing a non-compliance report with the CARF specialist. Alternatively, the ARTCC may choose to correct the situation.

All active special military activities at the ATCSCC are coordinated through the NOM who communicates them to/from the floor. If there is an active classified military, the CARF specialist is also out on the floor directing activities.

Log Mission and Prepare CARF Mission Envelope. The CARF specialist collects and documents all relevant information regarding an ALTRV including the original ALTRV Request, the CARF computer conflict detection report, the ALTRV message sent to interested centers, amendments, final approval, and any negotiations concerning the ALTRV. The information is arranged in the order it is received/generated with the most recent information on top. The information is thorough enough to allow any other TM specialist to process the ALTRV or to assist the user with changes. The CARF specialist generates a CARF Mission Envelope (i.e., AT Form 7610-5) to which all of the collected documentation is added. After the Mission is flown, the Mission Envelope is retained in the "Past 30 Day File" and is discarded after 30 days have elapsed.

5.3.2.1.3 CARF Specialist Workflow Priorities

During any given shift the CARF specialist may be working on coordinating and monitoring multiple ALTRV missions. Priorities are left to the discretion of the CARF specialist on duty. The recommended priority order is as follows:

- Airborne adjustments
- Sensitive short notice request that warrant immediate action
- Diversions due to technical or weather related problems
- Delays
- Mission conflict resolutions with lesser priority
- Scheduled mission requests.

5.3.2.1.4 Space Shuttle Missions

A NASA space shuttle launch/return is handled like any other ALTRV request. However, because of the frequency of shuttle missions, coordination is simplified by implementing a set of special procedures and CDRs that have been developed over time. The procedures define the MIT restrictions to apply and which CDRs to use for Florida departures during the shuttle launch. Similar procedures exist for the shuttle return.

5.3.2.1.5 CARF Computer

The CARF computer system was developed approximately 8 years ago by CACI and is installed on two Sun SPARC workstations in the secured CARF room at the ATCSCC. It is connected to the same LAN as the Special Use Airspace Management System (SAMS), but the two systems are not located in the same room. Neither the CARF computer system nor SAMS is part of the TFM infrastructure. The TFM Functional Audit Team was unable to determine if there is any data exchange between the CARF computer and SAMS.

The CARF program is used to detect and resolve conflicts between concurrent ALTRV missions. It tabulates crossing tracks, altitude separation and time difference between them. If there is a predicted conflict, it displays each mission in conflict and shows where the conflict will be. It is used to plot Open Skies[1] missions and provide information pertinent to obtaining rocket waivers. The CARF program produces a graphical plot on the world showing fixes, latitudes and longitudes.

CARF functions are essentially standalone. They have not been supported for years. The CARF database contains airspaces, routes, and LOAs for use in mission planning and analysis, but

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[1] Open Skies is a term used to refer to the most liberal type of air transportation agreement between two countries. The U.S. Model Open Skies agreement includes provisions for open entry on all routes, and unlimited capacity and frequency. This type of agreement maximizes potential competition and facilitates new services through cooperative arrangements among the participating countries' airlines. The Departments of Transportation and State are responsible for Open Skies agreements with other countries.

they are thought to be out-of-date and incomplete because the CARF database has not been updated in a long time.

5.3.2.1.6 ALTRV Security

Some ALTRV missions require secure handling due to their sensitive nature. Security measures in place include staff security clearances, physical security, secure communications and networking, and special procedures for secure missions. Each CARF specialist and MOS has a security clearance. The CARF computer is on a secure military network and is located in a secured ATCSCC room to which only authorized users with the proper security clearance has access. The CARF computer room contains a variety of secure communications devices including phones and fax machines. Additionally, each ARTCC/CERAP provides the CARF specialist with a current listing of trusted agents. The list is updated annually by March 1 and as needed.

ALTRV requests associated with a secure mission can be categorized as No Notice, Encrypt For Transmission Only (EFTO), or Secure Handling (i.e., mission has a security classification of Confidential, Secret, or Top Secret). The special handling associated with each of these categories is summarized below.

No Notice Mission. Every precaution is taken to safeguard the execution time and date of a No-Notice mission. Information concerning it is withheld from specified Air Defense Radar Facilities and/or specified interceptor squadrons. The following procedures apply:

- The Mission Project Officer specifies "NOPAR" in the remarks sections of an ALTRV request when mission information is to be withheld from all Air Defense Radar Facilities and fighter interceptor squadrons. When mission information is to be withheld only from specific Air Defense Radar Facilities and/or fighter interceptor squadrons, the facilities and/or squadrons are added to the ALTRV request immediately after "NOPAR."
- If required, the Mission Project Officer or the FAA Liaison Officer furnishes the concerned FAA facilities, in separate correspondence, a list of "trusted agents" or "eyes only officers" with whom the time and dates of the No-Notice mission may be discussed.
- ALTRV NOTAMs are not issued unless specific instructions have been received from the originator of the mission regarding its content.

ETO Mission. All ALTRV messages exchanged between CARF and ATC facilities that are categorized as Encrypt For Transmission Only are transmitted via secure Defense Communication Systems. EFTO messages are not transmitted to international altitude reservation facilities.

Secure Handling (i.e., Confidential, Secret, or Top Secret mission). Confidential, Secret, and Top Secret missions are classified. The following procedures are followed:

- Classified missions are not entered into the CARF computer until the ALTRV is declassified.

- CARF specialists manually plot conflict resolutions on all classified missions.
- Altitude reservation NOTAMs are not issued.
- All documentation associated with classified missions is stored in a safe until it is declassified or removed for destruction.

Classified missions normally carry a 24-hour On-or About Date of Release (OADR)/Declassify date and time. The CARF may decide to call the Project Officer to negotiate an early release date and time to allow for the proper planning of the mission and the timely dissemination of NOTAM information.

The CARF specialist is responsible for the U.S. Open Skies international treaty and the U.S./Russia Trust and Verify agreement. The CARF specialist plots the Russian flights that are allowed to enter the NAS at any time and place (approximately 26 per year) using the CARF computer. The CARF specialist also monitors all reports of unplanned flights entering the NAS, determines if they are associated with the prevailing treaties, and reports them to the Defense Threat Reduction Agency.

5.3.2.2 Special Use Airspace (SUAs)

Special Use Airspace (SUA) is an airspace volume where activities are confined because of their nature and/or where limitations may be imposed upon aircraft operations that are not a part of those activities. SUA types are defined in Exhibit 5-32. Types of Special Use Airspace.

Nationally defined SUAs are defined in ETMS adaptation and are considered permanent. SUA definitions consist of a name, a specified airspace volume, and an associated activity schedule. New SUAs that have not yet been included in the 56-day adaptation data update cycle are defined by the affected centers in local adaptation files. The local adaptation files are available to the Host Computer System (HCS) but not to ETMS. Restrictions are enforced during the times when the airspace is “hot”, i.e., being used for its intended purpose. SUAs may be used for commercial air traffic when they are not “hot” if coordinated with the military (e.g., use of VACAPES routes during severe weather rerouting (see Section 5.2.3.3 Reroute Tools/Techniques).

Exhibit 5-32. Types of Special Use Airspace

Type of SUA	Description
Alert Area	Airspace that may contain a high volume of pilot training activities or an unusual type of aerial activity, neither of which is hazardous to aircraft. Alert Areas are depicted on aeronautical charts for the information of nonparticipating pilots. All activities within an Alert Area are conducted in accordance with Federal Aviation Regulations, and pilots of participating aircraft as well as pilots transiting the area are equally responsible for collision avoidance.
Controlled Firing Area	Airspace wherein activities are conducted under conditions so controlled as to eliminate hazards to nonparticipating aircraft and to ensure the safety of persons and property on the ground.
Military Operations Area (MOA)	A MOA is airspace established outside of Class A airspace to separate or segregate certain non-hazardous military activities from IFR traffic and to identify for VFR traffic where these activities are conducted.
Prohibited Area	Airspace within which no person may operate an aircraft without the permission of the using agency.
Restricted Area	Airspace within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Most restricted areas are designated joint use and IFR/VFR operations in the area may be authorized by the controlling ATC facility when it is not being utilized by the using agency. Restricted areas are depicted on en route charts. Where joint use is authorized, the name of the ATC controlling facility is also shown.
Warning Area	A warning area is airspace of defined dimensions extending from 3 nautical miles outward from the coast of the United States, which contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning area is to warn nonparticipating pilots of the potential danger. A warning area may be located over domestic or international waters or both.

The MOS is an ARTCC's military liaison. Each day, the military provides the MOS with a daily schedule that indicates when SUAs are expected to be active during the next 24 hours. The daily schedule is hand-delivered, faxed, or verbally communicated via the phone. It contains the SUA name and the associated times and altitudes for each planned SUA activity. Adjustments to the daily schedule may be received throughout the day via the phone or fax, often with lead times of less than the preferred two hours. The MOS communicates scheduled SUA information to the appropriate center ATC and TM staff.

SUA coordination begins about two hours prior to when an area is planned to become "hot". The MOS coordinates with all of the affected sector controllers in the facility to determine the impact of the planned SUA activity. Sector controllers can refuse to allow use of some SUAs such as MOAs. They cannot refuse use of a Restricted Area. After consulting with the affected staff, the MOS contacts the military to confirm or deny the use of the SUA. If the SUA is to go "hot", the MOS issues a GI message indicating specific squawk codes and areas to be monitored for spill outs. The MOS logs all SUA activity in the position log and may enter SUA summary information into local tools such as the ZAU MAU Tool (see Section 6.3.10) that generates SUA activity strips for distribution to sector controllers. The MOS is required to enter all SUA activity into SAMS (see Section 6.4.7) at least once a day or anytime SUA information changes. Entries are made via a SUN workstation located at the MOS position that is connected to the secure network on which SAMS resides. SAMS is physically located at the ATCSCC.

5.3.2.3 VIP Movement

VIPs include the President (Air Force 1 and 2), his family (Executive 1), his cabinet, Heads of State, and political figures using military transport. VIP flights file normal flight plans through BASOPS. They are not ALTRV flights. VIP flights have call signs beginning with SAM (Special Air Mission) except for Air Force 1 and 2, Executive 1, and flights originating outside the U.S.

TFM staff gives VIP flights precedence over other flights during the implementation of TM initiatives. The ATCSCC NOM is informed of VIP movement. The NOM communicates VIP movement to TM specialists during the daily scheduled TELCONs and updates OIS with summary information. Information concerning Presidential flights is not released to anyone outside of the FAA except to those representatives specified in FAA Order 7210.3.

5.3.2.4 MOS Position

The MOS at an ARTCC is the Center's liaison with the military. At ZDC, the MOS reports directly to the Center Operations Manager and often assumes Operations Manager responsibilities as assigned. At ZAU, the MOS also obtains approval for preplanned equipment outages on behalf of Air Facilities (AF) and coordinates search and rescue activities.

Tools available at the MOS position include the KVDT, SAMS, and ETMS/TSD. They are used to support ALTRV and SUA activity.

5.3.2.5 Tools to Support Special Government Events

Exhibit 5-33. summarizes the tools used by TFM staff while handling special government traffic.

Exhibit 5-33. Tools Used During ALTRV Processing

User	Tool	Description of How Tool is Used	Reference to Functional Audit Tool Description
CARF Specialist	CARF Computer Program	Checks current ALTRV request with previous requests to determine if there is a conflict between them by tabulating crossing tracks, altitude separation and time difference between missions. Sends ALTRV message to affected centers via Service B and NADIN. Sends approved ALTRV information to the SAMS computer. Plots Russian and unplanned flights entering the NAS.	5.3.2.1.5
	Clear Plastic Map Overlays	Used to plot proposed ALTRVs for secure missions & whenever the CARF computes is unavailable	N/A
	TSD	Used to monitor weather and military callsigns while an ALTRV mission is airborne. An FEA could be defined and used to mimic a stationary ALTRV to determine acceptable reroutes around it.	6.1.23
ARTCC MOS	Facility Airspace Map Templates on Paper	Used at some facilities when drawing a proposed ALTRV route to determine if the proposed route violates any locally defined MOA/LOAs.	N/A
	TSD	Reroute function is used to determine an alternate ALTRV route that does not violate locally defined MOA/LOAs. Also used to monitor weather and military callsigns while an ALTRV or VIP mission is airborne. Used to monitor traffic flows both before and during SUA activation.	6.1.23
	KVDT/HCS	Used to automatically generate flight strips for an ALTRV mission without retaining an electronic version of the Mission Flight Plan	N/A (Neither KVDT nor HCS belong to the TFM Infrastructure)
	Local Tools (e.g., ZAU MAU)	Used to enter SUAs and to print out SUA summaries, strips, and teletype forms.	6.3.10 (ZAU MAU)
ATCSCC NOM	OIS	Used to update VIP Movement information.	6.2.5
TMC	TSD	Used to monitor ALTRV and VIP flights, assess impact of requested SUA activation, and monitor impact of "hot" SUAs. An FEA could be defined and used to mimic a SUA or stationary ALTRV to determine acceptable reroutes around them.	6.1.23
	OIS	Used to obtain status of VIP movement.	6.2.5

5.3.3 Plan for Special Civilian Events

This subsection describes the processes, tools, and data used at both national and local traffic management facilities to handle special civilian events, such as NASCAR events and the Super Bowl, as well as High Density Traffic Airport (HDTA) traffic.

5.3.3.1 Special Traffic Management Program (STMP)

Special civilian events such as the Indianapolis 500 and the Kentucky Derby often result in abnormally large traffic demands for a specific location over a short period of time. In order to accommodate the increased traffic demand, the FAA establishes a Special Traffic Management Program (STMP). A STMP requires non-scheduled IFR flights to reserve arrival and departure time slots at the affected airport(s). By implementing a STMP, the number of arrivals and departures generated by an event are controlled, allowing for a limited number of reservations in specific time intervals. Additionally, flights into and out of the affected airport(s) may be required to use specific arrival and departure routes depending upon the volume of normal traffic and additional traffic expected. A STMP time slot reservation does not take the place of a flight plan. Flight plans must also be filed. The reservation (slot) number must be included in the flight plan Remarks field.

While a STMP is usually only applied to non-scheduled IFR traffic, this is not always necessarily true. For large events where the FAA expects there may be a significant number of VFR flights arriving and/or departing in the airspace where the event is to occur (such as for Oshkosh), a decision may be made to publish the associated STMP with a requirement for VFR pilots (as well as non-scheduled IFR flights) to secure reservations in advance of filing a flight plan, using the STMP interfaces (e-STMP or touch tone) described in Section 6.1.1.2.11. This may be done in order to provide STMP procedure designers with a better estimate of total demand, so they can determine requirements for additional staffing or a temporary tower for the event.

5.3.3.1.1 Making STMP Reservation

Each STMP has a NOTAM that is published approximately two months in advance of the event. It summarizes the airports included in the STMP, the date(s) and times(s) when reservations are required, the procedures for making a slot reservation, and any special arrival/departure procedures for the event. Exhibit 5-34. provides an example of a STMP NOTAM.

All non-scheduled IFR flights must obtain a slot reservation. In most cases, the e-STMP web application (see Section 6.1.8) is used for making reservations; however, in some cases the users may be required to contact the controlling ARTCC to make a reservation. Users experiencing difficulty with e-STMP or without access to e-STMP can make a reservation through a Flight Service Station (FSS) or by using a touchtone phone or contacting the Airport Reservations Office at the ATCSCC. Regardless of how a reservation is made, it is recorded using e-STMP.

A STMP may result in prescribed approach and departure routings for an airport for that event. This information is disseminated through the STMP NOTAM. When a reservation or flight plan is filed through an FSS, the FSS consults the NOTAM and informs the pilot of the prescribed routing.

2002 Penn State Football Games
State College, Pennsylvania
SPECIAL TRAFFIC MANAGEMENT PROGRAM

August 31, 2002 - November 23, 2002

In anticipation of a large number of aircraft operating to and from the State College, Pennsylvania, area in conjunction with the 2002 Penn State Football games, a Special Traffic Management Program (STMP) will be implemented to enhance safety and minimize air traffic delays.

SPECIAL TRAFFIC MANAGEMENT PROGRAM

The Federal Aviation Administration Air Traffic Control System Command Center (ATCSCC) will utilize a Special Traffic Management Program, and slot reservations will be required for all domestic, non-scheduled IFR arrivals to the following airports:

AIRPORT	IDENTIFIER
Bellefonte	N96
Mid-State	PSB
University Park	UNV

Slot reservations will be required for all domestic, non-scheduled IFR Arrivals during the following dates and times:

DAY	Date	Opponent	Reservations Requirerd for the Following Dates and Arrival Times (UTC)
Saturday	August 31, 2002	Central Florida	8/31/02 - 1100 to 2000
Saturday	September 14, 2002	Nebraska	9/14/02 - 1100 to 2000
Saturday	September 21, 2002	Louisiana Tech	9/21/02 - 1100 to 2000
Saturday	September 28, 2002	Iowa	9/28/02 - 1100 to 2000
Saturday	October 19, 2002	Northwestern (Homecoming)	10/09/02 - 1100 to 2000
Saturday	November 2, 2002	Illinois	11/02/02 - 1100 to 2000
Saturday	November 9, 2002	Virginia	11/09/02 - 1100 to 2000
Saturday	November 23, 2002	Michigan State	11/23/02 - 1100 to 2000

Reservation requests can only be made within 72 hours of the days' events.

HOW TO OBTAIN A SLOT RESERVATION

Pilots may obtain a slot reservation by using computer interface (e-STMP) or touch-tone telephone interface.

- **e-STMP:** computer access is available to users with an Internet connection and web browser. The Internet address is *www.fly.faa.gov/estmp*. A guide is available on the web site.
- **Touch-tone telephone: dial (800) 875-9755 and follow the prompts.**

Pilots should be prepared to provide their departure/destination airport, estimated UTC time of departure/arrival, UTC date, call sign, and type aircraft. Upon completion of a slot reservation, you will receive a reservation confirmation number. **The slot reservation confirmation number must be included in the remarks section of the flight plan.**

Aircraft are expected to arrive within +/-15 minutes of the assigned reservation time. If a reservation requires change or cancellation, please do so as early as possible in order to release the slot for another flight.

The reservation system will be available 24 hours a day. If you experience difficulty completing a slot reservation, you may contact the Air Traffic Control System Command Center (ATCSCC), Airport Reservation Office (ARO) at (703) 904-4452. **The ARO telephone number is for reservations only, not for information concerning the STMP.**

Except for emergency situations, flights without approved "Slot reservation confirmation number," airfiles, and change of destination requests on airborne flights to N96, PSB, and UNV will not be accepted while this STMP is in effect.

Exhibit 5-34. Example STMP NOTAM

5.3.3.1.2 STMP Processing Steps

This section describes the steps that are performed within the FAA to plan, implement, and evaluate STMP procedures and traffic flow.

Planning Phase. Several months before the special event is scheduled to occur, the event organizer contacts the affected TMU and provides it with the dates of the event, an estimation of the traffic demand, and the anticipated direction of the arriving/departing traffic. The controlling facility for the event location coordinates the event with adjacent centers affected by the event and notifies its regional FAA office (i.e., Eastern, Southern, Great Lakes, Central, Southwest, Northwest Mountain, Western Pacific, or Alaska Region) with the resulting details.

Coordination with Adjacent Centers

The TMU from the affected facility coordinates with TMUs in other affected centers to determine if any special traffic procedures need to be defined to handle the extra volume of air traffic. Coordination and planning may involve defining special routes to handle the additional traffic, MIT restrictions, approach altitudes and speeds, arrival/departure runways, and ground procedures such as where to park. If the event is a repetitive annual event, procedures from previous years are reused and/or adjusted to improve safety and minimize air traffic delays. The TMU specialist documents the resulting procedures in a draft NOTAM intended to announce the event to flight operators. Some AT facilities, like the Southern California TRACON (SCT), choose to designate one of the TMU specialists as a Special Events Coordinator because of the high number of special events that occur within their boundaries.

Notification to Regional FAA Office

The coordinating facility provides event details to its regional FAA office 90 days in advance of the event, as specified in *FAA Order 7210.3, Chapter 17, Section 12*. At Washington Center (ZDC), the Operations Manager performs this communication with the regional office using an FAA Memorandum that includes the following information:

- The reason for implementing special procedures and a statement of system impact, including the total number of additional flights expected.
- Airport(s)/sector(s) to be controlled.
- Capacity restraints by user category (i.e., air carrier, air taxi, general aviation, military) per hour per airport.
- Hours capacity must be controlled.
- Type of flight to be controlled (e.g., unscheduled, arrivals, departures, IFR, VFR).
- Days of the week and dates (e.g., Thursday, May 7 through Monday, May 11 or Friday, May 22 and Sunday, May 24).
- A draft copy of the associated NOTAM and temporary flight restrictions (electronic mailing of this item is preferred).
- IFR/VFR capacity at each airport/sector.

- Resource cost estimate including staffing and telephone requirements.
- The number of slots to be allocated per airport, or group of airports, per time increment (e.g., ten arrivals every fifteen minutes or forty aircraft every sixty minutes).

Processing by FAA Regional Office

The regional office reviews and forwards the request to the ATCSCC for coordination and approval 60 days in advance of the event. Additionally, the regional office forwards the NOTAM to Air Traffic Publications no later than 28 days prior to the next NOTAM publication date so that the STMP NOTAM is publicized in at least two issues of the Notices to Airmen, which is published monthly.

Creation of the STMP Slot Program

When the ATCSCC receives the event request, the Operations Support staff at the ATCSCC initiates a Slot program for the event. Refer to Section 6.1.8.2.2 e-STMP Database Administration Component for additional details. The Slot program must be in place to support user reservations by the time the STMP NOTAM is published.

Preparation for Event At TMU

Several days prior to the beginning of the event, the TMU or Operations Manager distributes an internal advisory summarizing the upcoming event and the impact that it is expected to have on center operations. Exhibit 5-35. provides an example of an internal STMP advisory.

Note that all ARTCCs have the ability to retrieve slot reservation lists. The CSA on duty has detailed instructions and a password for accessing the STMP database administration program. The list of slot reservations may be needed by the TMC during final preparation for the STMP event.

WASHINGTON TMU
TRAFFIC MANAGEMENT UNIT ADVISORY

Number: 02-45 **Date: July 08, 2002**

To: All TMU PERSONNEL/Area Supervisors

Subject: BUSCH 200 Nascar Race
New Hampshire Int'l Speedway
May 11, 2002

On Sunday, Jul 21st, the New England 300 Nascar race will be held at the New Hampshire Int'l Speedway, in Loudon, NH. This area is served by CON (Concord), LCI (Laconia), and MHT (Manchester) airports. Nascar expects about 180 aircraft arrivals/departures for this event with approximately 100 of these originating from and returning to the CLT area. The vast majority of arrivals will be on Thursday, Jul 18th throughout the day. Routes are specified in the attached package. ZNY and ZOB anticipate no altitude restrictions on this traffic. The race will end on Sunday afternoon sometime around 4:00 pm local. Departure demand out of the New Hampshire area will begin to build 30-60 minutes later lasting approximately 2 hours.

Attached, find the arrival and departure routings for CON/LCI/MHT, a copy of the 120 day test agreement for the NASCAR1 STAR and a copy of the NASCAR1 STAR.

Please ensure that traffic flows to/from these airports are being monitored and that staffing levels are adequate and appropriate traffic management initiatives are in place for the anticipated volume. If you have any questions regarding this memo, please contact Bill Lash, Alyce Hood-Fleming or myself.

Thank You,

Mike Klinker, Operations Manager

Exhibit 5-35. Example STMP TMU Advisory

Implementation Phase. On the morning of the event at about 8:30 A.M., the ATCSCC sends a list of all STMP reservations for the day to the TMU in whose area the event is located. This allows the TMU to plan for the day's activities before the flight plans show up in the system. The affected TMU monitors the special TM programs to ensure that the demand to the center/terminal facilities is equal to the capacity. If conditions warrant during the STMP (e.g., changing weather, cancelled flights), the TMC works with the Area Supervisor to determine if STMP restrictions can be relaxed. For example, if many of the reserved slots are for cancelled flights or VFR conditions prevail (note that STMP arrival/departure rates are set for IFR conditions), a higher acceptance rate can be accommodated. If so, the TMU contacts the ATCSCC to request the change.

All STMP coordination and STMP initiatives (i.e., changes to established STMP restrictions) are logged.

Post-Analysis Phase. Completed STMPs undergo post-analysis by a TMC to determine what worked well and what did not. Recommendations for improving the procedures that did not work well are made. Annual events and, possibly, air traffic in general benefit from post analysis changes. For example, a tremendous increase in sector demand caused by a STMP may result in future agreements to use specific routes for aircraft departing from specified locations (either for the next occurrence of the event only or on an extended trial basis).

5.3.3.2 High Density Traffic Airports (HDTA)

As of July 2, 2002, the FAA limits the number of flight arrivals and departures during certain hours of operation at three high-density traffic airports (HDTAs): John F. Kennedy International Airport (JFK), LaGuardia Airport (LGA), and Ronald Reagan Washington National Airport (DCA). Chicago O'Hare International Airport (ORD) was recently dropped from the HDTA list.

The number of flights (i.e., slots) permissible at each HDTA for each class of user (i.e., air carrier, commuter, and other) is specified in *Title 14 of the Code of Federal Regulations (CFR) Part 93, Subpart S*. To ensure that the specified HDTA quota is not exceeded, a reservation is required for all aircraft departing or landing between the operating hours specified for each HDTA. Reservations for regularly scheduled air carrier and commuter flights are handled differently than non-scheduled flights (i.e., for the “other” class of HDTA users). Each is discussed separately below.

5.3.3.2.1 Regularly Scheduled Air Carrier and Commuter Flights

Airport reservations (also called slots) for regularly scheduled air carrier and commuter flights are allocated in accordance with *Title 14 of the Code of Federal Regulations (CFR) Part 93, Subpart S.* These reservations involve written documentation and lotteries and, in the context of the TFM environment, can be considered permanent. OAG flight schedules are consistent with the slot allocations.

5.3.3.2.2 Non-Scheduled IFR Flights

The FAA has established an Airport Reservations Office (ARO) resident at the ATCSCC to receive and process all reservation requests for non-scheduled IFR flight operations (i.e., IFR operations for GA and non-regularly scheduled air carrier and commuter flights). This office allots reservations on a "first-come-first-served" basis as determined by the time the request is received at the reservation office. It also monitors operation of the high density rule for all IFR user classes to ensure that flight operations are in compliance with the high density rules and to identify improvements to the reservation process. The ARO is staffed by the TCA position.

The ARO allocates reservations through the use of the e-Computerized Voice Reservation System (e-CVRS), which is currently available to users through a touch-tone telephone or a web browser. Refer to Section 6.1.3 for a detailed description of e-CVRS and the reservation requirements that are currently imposed. Flight operators also may contact the ARO by phone or may file their request with the nearest Flight Service Station (FSS) by any available means. Regardless of how a reservation is made, it is recorded using e-CVRS.

A reservation number is issued after the following mandatory information is received.

- Name of the high density traffic airport

- Date and hour (UTC) of proposed operation
- Whether the flight operation is an arrival or departure
- Aircraft call sign, flight identification, or tail number.

All IFR operators are encouraged to advise the ARO, prior to the beginning of the reserved time slot, whenever a reservation needs to be cancelled or changed. For other than scheduled air carriers/commuters, cancellations and changes are made using the same methods as used to reserve the slot. Scheduled air carriers and commuters use FM and FX CDM messages for modifications and cancellations.

A reservation or a slot reservation approval number is not an ATC clearance, nor does it constitute the filing of a flight plan. There is no automated link between e-CVRS and any other TFM application. The ARO monitors compliance with the requirement to obtain a reservation at the HDTAs by comparing ATC flight records with e-CVRS reservation data. IFR flights without slot reservations are permitted to fly, but their operators are subject to a fine.

5.3.3.2.3 VFR Operations

All VFR operations are considered to be outside of the HDTA quota established by *Title 14 of the Code of Federal Regulations (CFR) Part 93, Subpart S*. However, VFR reservations may be granted if they can be accommodated without significant delay to operations already allocated. The FAA ATC facility that serves the HDTA is responsible for granting all VFR departure and arrival reservations. An ATC clearance to enter the airspace or depart the airport constitutes an approval for a VFR reservation. No additional reservation is required.

5.3.4 Analyze TM Initiative Effectiveness

This section describes the processes, tools, and data used at both national and local traffic management facilities to analyze previous traffic management initiatives to assess program effectiveness. The goal of post event analysis is to identify lessons learned with the intent of developing more efficient future initiatives.

There are two types of analysis being performed: System Impact Assessment and Performance Analysis. In addition, Incident Investigation often requires that post-event analyses be performed, with a slightly different purpose in mind – to reconstruct events to discover what caused a particular problem to occur or persist.

The following discussions are included in this section:

- System Impact Assessment
- Performance Analysis
- Incident Investigation
- Tools to Support Post Event Analysis
- Analysis at Local Facilities
- Data Quality Analysis at Volpe.

5.3.4.1 System Impact Assessment

System Impact Assessment looks at the system in a near real-time manner, measuring the impact of air traffic management actions on the system as they occur and/or predicting the downstream impacts of traffic management initiatives that are being considered.

The tools most often used to conduct real-time system impact analysis include the TSD, FSM, and RT FSA. RT POET is also used.

Use of these tools for real-time analyses has also been described in the various TM initiative discussions in Section 5.2. These analyses are conducted in the operational environment to determine an initiative strategy, monitor initiatives in effect, and obtain information to support adjusting the strategy over time to meet flow and capacity/demand balance objectives.

The ATCSCC, as the authority responsible for monitoring and implementation of TM initiatives with 'national' scope, performs most real-time impact analysis using these tools. Since the ATCSCC mandate is to identify impacts within the broader NAS arena, specialists there investigate and document initiative decisions extensively. Local facilities impacted by initiatives, as well as involved CDM airlines, all perform their own real time assessments, and contribute evaluations and opinion in this collaborative process. Often assessments done at field facilities in real time are based more on specialist knowledge and experience due to time constraints. When the above tools are used in local facilities, it is often the supervisor who performs the analysis.

The results of system impact assessments are fed directly back into managing active and proposed TM initiatives during the day and also provide data for use in post event performance analysis.

5.3.4.2 Performance Analysis

Performance Analysis is used to assess the efficiency of an event/initiative after it has occurred. Operational data and post event analysis results which address the needs of ATC and TFM operations directly is usually provided in the form of reports and briefing packages, to specialists/managers at the ATCSCC, local facilities, and the user (airline, military) community.

The Quality Assurance (QA) specialist at the ATCSCC is responsible for studying past ground delay programs and other initiatives to see how well the programs performed compared to their intended goals. Quality Assurance is most concerned with data quality and compliance issues.

Supervisors and specialists at local facilities perform some post event analysis, usually when required to provide documentation for particular initiatives. Traffic Analysts at some local facilities also acquire, format, analyze and output various reports for use by supervisors and managers in reviewing daily operations, as well as to be sent to other FAA facilities and offices.

Volpe provides data quality and compliance reports on its Volpe CDM DataGate website for use by Quality Assurance specialists and airline operations analysts. See following subsection on Data Quality Analysis at Volpe.

Airline operations analysts use TFM data to perform post-event analysis for identifying operational (in)efficiencies and scheduling requirements.

Beyond this, other offices at FAA Headquarters and in other departments regularly use TFM data for many analysis purposes, such as to evaluate airspace and procedure design, system capacities and growth potential, and staffing and training requirements, or to identify security issues. Operational data and post event analysis results which address the needs of these external offices are usually provided in the form of reports of various types (i.e. OPSNET reports are delivered daily to FAA regional and national headquarters). The processes and tools used for these activities by FAA Headquarters and other departments are beyond the scope of this report and are not discussed here.

Operational Review

Daily, specialists and managers who participate in operational review meetings examine the results of TM Initiative analysis conducted on the previous day's programs.

The results of these analyses are, in general terms, used to:

- Validate operational decisions/program effectiveness
- Monitor the CDM process and tool/data use
- Ensure adherence to current processes and compliance to initiative directions

- Identify data quality issues
- Identify constraints, process gaps and improvements
- Investigate incidents as required
- Identify system and training requirements.

Data Quality and Compliance

In order for a ground delay program to produce the desired results, the program must be based on accurate data and flights must arrive at their designated CTAs. Poor data quality results in inaccurate demand predictions. Non-compliance results in the program delivering above or below the airport acceptance rate.

Impacts of poor data quality and non-compliance include:

- Unnecessary ground delay programs
- Flights may take longer delays than necessary.
- Program may deliver light or heavy
- Unnecessary airborne holding
- More revisions
- GDP may be longer than necessary
- “Rolling Spike”.

In determining data quality, the QA specialist examines cancellations, delay information, data concerning new flights added during events, time enroute, and duplicate flight records to ensure that timely, accurate and complete information is being sent from airline systems to ETMS.

In assessing compliance, the QA specialist looks at whether flights departed/arrived within the ten (10) minute EDCT/CTA windows (minus 5 to plus 5 minutes), and whether their actual times enroute varied greatly from what was originally filed.

For data quality analysis, the QA specialist uses FSM capabilities to check:

- Alerts - CTA and EDCT compliance, ETE Verses Actual
- Reports - Timeout cancellations, timeout delays
- Flight lists - duplicate flights, schedule verification
- Color by Alarm
- Color by compliance

For GDP analysis, the QA specialist uses (Post-Analysis) FSA to recreate events of the previous day to look for:

- GDP performance measurements: Aircraft landed versus airport AAR/program rate, Rate Control Index, Delay (ATC, Absolute), Airborne Holding.
- Factors that impact performance: Compliance To Control Times, Data Quality (Pop-ups, Timeouts, Processing Errors), Forecast Accuracy (Enroute Times, Arrival Times), Slot Usage, Operational Practices

RT FSA is used by specialists to monitor ground delay programs as they are being implemented and to produce reports for later review. This web-based version is used to provide traffic management specialists with a way to spot problems and take corrective action as events are occurring.

RT FSA analysis is used to:

- Monitor compliance to control times
- Detect system gaming
- Identify data processing errors and other data quality problems
- Identify operational practices that lead to under or over delivery
- Identify issues with current slot assignment procedures

RT FSA produces several different kinds of reports (described below in this section):

- Performance Reports
- Compliance Reports
- Data Quality Reports

These reports are dynamically updated every five minutes as new flight information is received via ADLs. The drill-down features allow specialists to interactively query the database for additional information.

5.3.4.3 Incident Investigation

Whenever there is an operational incident, an Operational Review Board is usually rapidly assembled to do a Quick Incident Review. All data that in any way can be associated with the time period or flights in question is gathered and examined within a few hours or days. Anyone who has any connection with the event is interviewed. Events are reconstructed from every angle possible using data from every tool and source involved. The process used to examine events, though hastened by the need to report on the incident quickly, essentially follows the same course as for a routine daily Operational Review.

5.3.4.4 Tools to Support Post-Event Analysis

TFM tools routinely being used for operational post event analysis are FSM, FSA, and POET.

Other tools used to produce reports, recreate events, or provide data for further automated or manual analyses include TSD, Facility Logs, DSP, PDAR, FACET, and DPAT. The following subsections briefly describe how these tools support post event analysis. Further discussions of these tools (except for DPAT) are found in Section 6, TFM Tools and Products.

5.3.4.4.1 Flight Schedule Monitor (FSM)

In 'Live Data Mode', FSM allows traffic management specialists to monitor current capacity and demand. Using Monitor Mode GDT (Ground Delay Tools), specialists model traffic management initiatives for operations planning and GDP/GS implementation. The Demand Graph and Timeline are the most often used analysis functions in 'Live Data Mode'.

In 'Historic Data Mode', specialists use Monitor Mode to review events and changes that took place throughout the day by setting the time to a specific ADL update to recreate the exact circumstances under which an event took place.

The Historic Mode GDT capabilities provide the 'What If' functions that allow specialists to analyze impacts of implementing other alternatives using the same event scenario. In Historic Mode, users can step back up to one hour before a particular ADL time, move ahead and back in time (using the Set Time function), and step forward one update at a time (using the Update function). The Reset function sets the data time back to the beginning of the day in preparation for a step through. This mode is most often used to produce daily traffic counts, model alternative GDP scenarios and replay GDP events. All functions used to monitor flight schedule, model and monitor traffic management initiatives and plan airline responses are available in 'Historical Data Mode', as they are in 'Live Data Mode'.

FSM Airborne Holding Flight List and Carrier Statistics reports can be generated and retained for further analysis.

Airline operations personnel use FSM to model the impacts of a particular program on their operations and evaluate the effectiveness of proposed responses, as well as to review previous events much like ATCSCC specialists do.

FSM uses ADL data, updated every five (5) minutes, as the basis for its analysis functions.

Airlines may also use ADL data to provide a basis for internal analysis, however, ADL reports differ from standard ETMS list reports in that ADL data sent to airlines is filtered so that the airline can see full data only for its own flights.

5.3.4.4.2 Flight Schedule Analyzer (FSA)

FSA is a tool developed to explore the effectiveness of GDPs and to identify problems in the ADL data used in CDM. This tool, available in two versions FSA and RT FSA, is used primarily by the ATCSCC and the AOC analysts.

The Quality Assurance group at the ATCSCC uses FSA to review and reconstruct each day's GDPs. This information is included in morning facility briefing packages and discussed at the operational review and planning meetings at the ATCSCC.

The CSA at the ATCSCC monitors the RT FSA via the OIS, in order to quickly detect airlines with data delivery problems and compliance issues. Missing airline data has a potentially great impact on demand assessment. Compliance affects program performance and efficiency. If the CSA notices problems with the data coming from a particular airline, he/she contacts the airline to discuss the problem. The airline specialist may then use the report capabilities (described below) to research the problem if the issue is not immediately resolvable.

FSA can produce the following reports:

- Time Out Delay: The Time Out Delay (TOD) report lists all flights that are currently in time out delay. These flights are still on the ground after their estimated time of departure (ETD). Time out delays affect the accuracy of the demand prediction at an airport and may lead to unnecessary program revisions as well as unused slots. The presence of a large number of flights on the time out delay report may indicate an airline is not sending in delay information. A large number of time out cancelled flights may indicate that there is a problem with duplicate call signs.
- Pop-ups: The Pop-Ups report shows all pop-ups (non-scheduled flights) expected to arrive during the program hours. Pop-ups affect the accuracy of the demand prediction at an airport and may lead to additional delays with other traffic management initiatives like airborne holding, MIT, or ground stops. To reduce the number of pop-ups, airlines may add flights that regularly appear in the list to the database via the daily download process. A large number of time out cancelled flights may indicate that there is a problem with duplicate call signs due to flights getting entered into the ETMS flight database under one call sign but then operating under a different call sign when the flight plan is filed. The pop-up report shows all unscheduled flights that have been filed since the initial GDP was executed. The Pop-Ups report will show all pop-ups regardless of whether they have subsequently been given a slot in a revision.
- Duplicate Flights: The Duplicate Flight report allows the user to easily see demand that might not materialize by identifying similar flights that appear in FSM. They may be due to data processing errors, such as ETMS flight mismatches. However, some shuttle flights and wingtips may also be flagged as duplicates. Bad data affects the accuracy of demand prediction at an airport and may cause operating flights to suffer more delay than necessary. Airlines look for the double filing of flights due to a data processing problem or communication problems, as with the recodes. Users also cancel shuttle flights and wingtips that appear on this list that they are not intending to operate.

- CTD before PGTD: The CTD Before PGTD report identifies flights whose Control Time of Departure (CTD) is earlier than their Proposed Gate Time of Departure (PGTD) and has either not departed, or has departed and is non-compliant based on the compliance window specified in Real-Time FSA. These flights have a high probability of not being compliant with their CTD, and cause operational issues for tower controllers. Often controllers will have to call for new EDCTs for these flights if the flight plans to depart more than 5 minutes after its control time. To reduce the occurrence of this operational issue, airlines confirm that delays (i.e., Airline Runway Time of Arrival (LRTA) and/or ERTA fields) that coincide with the Proposed Gate Time of Departure and Proposed Gate Time of Arrival (PGTD/PGTA) are sent in as far in advance as possible.

- Compliance: The Compliance report shows all flights that did not comply with their assigned Controlled Time of Departure (CTD). A flight is considered "non-compliant" if it failed to depart within the compliance window specified in Real-Time FSA. Note that the traffic management initiatives run outside of FSM, like ground stops, will impact the accuracy of the report. Airlines reference the Compliance report to be aware of any compliance issues. By default, FSA uses a (-5, +15 minute) compliance window. Authorized ATCSCC personnel may change the compliance window through the Site Administration link on the FSA home page. FSA uses the CTD assigned to the flight and when it departed to measure compliance. Departure status is determined by looking at the ETD prefix. A prefix of "E" or "A" indicates that flight has departed. The ETD prefix is being used to determine departure status instead of Actual Runway Time of Departure (ARTD), in order to capture flights that have departed for which ETMS doesn't receive ARTDs (i.e. flights which started out VFR).

- Cancels that Flew: The Cancels That Flew report lists all controlled flights that were cancelled then operated without being reinstated via an FM, FZ, or FA message. Flights that flew without being reinstated affect the accuracy of the demand prediction at the airport and can lead to over-delivery. Airline data quality is lacking when flights appear on this report. Either delay updates are not being sent in when the flight time out (TO) cancels, or a flight was intentionally cancelled and then never reinstated after deciding to operate the fight.

- GDP Events: All GDP actions executed through FSM are listed on the GDP Events report including RBS++, compression, ground stops, and +/- delays. Airlines can review the report to see which parameters of the FSM events had been part of a GDP.

- Flight Status: The Flight Status report shows the current status of all program flights including cancelled flights. This report contains the only list with all flights included in the GDP.

- Performance: The Performance Report shows whether a program is delivering the requested Program Rate. This report helps to reveal the extent at which compliance and data quality impacts the program delivery. Airlines review this report to determine the major issues that are impacting the success of a GDP.

These reports are updated every 5 minutes with the most current ADL information. They are viewed via the ATCSCC OIS pages.

For each program hour, a report displays the program rate, number of slots, number of cancellations, extra demand, displaced demand, and the total demand expected. These counts are the key to understanding why the program is over or under delivering for a particular hour. An explanation of each count is provided in Exhibit 5-36. FSA Report Data Description.

The data used in FSA can be filtered and grouped in a variety of ways, and a number of reports and types of analysis are available. FSA can display most information graphically. For example, a cumulative distribution plot may be used to show the accuracy with which different airlines predict their en route times in the data records they submit to the FAA. And a scatter-gram can be used to show the compliance with controlled departure and arrival times for each flight affected by a particular GDP.

Drill down (for details about individual and groups of flights) and Flight Lookup capabilities are also FSA functions that find use at the ATCSCC and CDM airlines. Reports can be copied, saved, and printed.

Exhibit 5-36. FSA Report Data Description

Row	Description
Program Rate	The rate set in FSM by the traffic management specialist. The rate shown will be pro-rated for partial hours at the beginning of the program. The rate will also be prorated if it changed in the middle of an hour due to a revision.
Number of Slots	The number of slots FSM created for that hour. Sometimes the number of slots will not equal the requested program rate due to a number of factors. See Appendix A for further explanation.
Cancellations	The number of cancelled flights in the hour. This number will equal the number of squares on the FSM timeline for the hour.
Extra Demand	The number of extra flights showing up in the hour that do not have an FSM assigned slot in the hour. The extra demand is typically due to pop-ups, flights that should have shown up in an earlier hour (they have a slot time prior to the hour), or flights that should be showing up in a later hour (they have a slot time in a later hour). Occasionally, extra demand may be due to "Non-program" flights. These are flights that were not originally given a slot by FSM because they were not expected to arrive during the program hours. For instance, flights may delay into the first hour of the program after the initial program is run.
Arriving Prior to Control Hour	The number of flights, which should have shown up in the hour (they have slot times in the hour), but are expected to arrive in an earlier hour due to an early departure or some other reason.
Arriving After Control Hour	The number of flights which should have shown up in the hour (they have slot times in the hour) but are expected to arrive in a later hour due to a late departure or some other reason.
Total Demand	The total number of flights expected to arrive in the hour at the ADL time shown at the top of the report. The Total Demand for an hour will equal the number of slots allocated minus the "No-shows" (i.e. the Cancellations and flights Arriving Prior to and After Their Control Hour) plus the extra flights arriving in the hour that do not have slots in the hour (i.e. the Extra Demand).

- Find in page
- Site Search
- ^UP^
- Performance
- Flight Status Page
- Cancels That Flew
- Compliance
- CTD < PGTD
- Pop-Ups
- Time Out Delay
- Duplicate Flights
- GDP Events
- Text Version
- Lookup Flight
- Back to main menu
- Help

ATL Time Out Delay Sorted By ETA

Flight list generated at 1238z on 1/30/2002

* An asterisk indicates the flight has not yet departed

Hour	ACID	Origin	DCenter	CTD	CTA	ETA	Minutes in TOD	Cancel Status
1500	CAA346*	HTS	ZID	30/1114	30/1250	30/1502	145	
1400	CAA594*	SRQ	ZMA	30/1109	30/1232	30/1450	145	
	AWE613*	LAS	ZLA	30/0956	30/1252	30/1448	83	TO cancelled at 30/1002
	DAL387*	LGA	ZNY	30/1232	30/1440	30/1445	5	
	CAA735*	ICT	ZKC	30/1120	30/1259	30/1414	75	
	CAA407*	SBN	ZAU	30/1231	30/1410	30/1413	0	
	CAA240*	ILM	ZDC	30/1120	30/1256	30/1411	75	
	CAA232*	ILM	ZDC	30/1111	30/1249	30/1410	83	
	TRS11*	MDW	ZAU	30/1216	30/1347	30/1410	20	
	CAA339*	ORF	ZDC	30/1108	30/1247	30/1406	90	
	N300K*	DTW	ZOB	30/1142	30/1307	30/1403	55	
	N880GC*	DTW	ZOB	30/1146	30/1312	30/1402	50	
1300	CAA8*	GNV	ZJX	30/1109	30/1228	30/1347	90	
	CAA256*	FLO	ZJX	30/1139	30/1251	30/1347	54	
	RYN38*	DAY	ZID	30/1111	30/1206	30/1342	83	
	CAA338*	TRI	ZTL	30/1156	30/1255	30/1336	40	
	CAA96*	BQK	ZJX	30/1154	30/1253	30/1333	40	
	CAA520*	JAN	ZME	30/1221	30/1317	30/1330	13	
	CAA144*	VLD	ZJX	30/1109	30/1147	30/1327	84	
	CAA374*	AGS	ZTL	30/1215	30/1301	30/1326	20	
	CAA431*	AGS	ZTL	30/1156	30/1229	30/1314	40	
	CAA317*	FAY	ZDC	30/1208	30/1310	30/1311	0	
	CAA460*	MGM	ZTL	30/1142	30/1217	30/1311	55	
	CAA34*	CHA	ZTL	30/1113	30/1149	30/1310	79	
	CAA271*	AVL	ZTL	30/1221	30/1303	30/1306	0	
1200	CAA677*	MCN	ZTL	30/1218	30/1242	30/1257	15	
	EWW38*	DAY	ZID	30/1100	30/1204	30/1221	10	TO cancelled at 30/1107

Exhibit 5-37. RT FSA Time Out Delay Report

5.3.4.4.3 Post Operations Evaluation Tool (POET)

POET provides a means to explore events that actually occur in the NAS and compare them to the events that were planned. Trend analysis, using its data mining capabilities, is one of POET's most important functions. Comparisons are performed using a variety of performance metrics including departure, en route, and arrival delays and filed versus actually flown flight tracks. POET helps identify areas of NAS congestion or inefficiency.

The POET database server, currently installed at the ATCSCC, is continually updated from live data feeds of NAS operations. The "rolling" 50-day data set spanning the entire NAS is available for use in trend analysis and daily performance monitoring.

Using POET, specialist and QA personnel can view flight information by conducting a search for flights that meet specific criteria, generating a summary report that includes specific flights, or pulling up one of the advanced charts.

Search results include a table, a chart, and a map. POET generates the report in HTML.

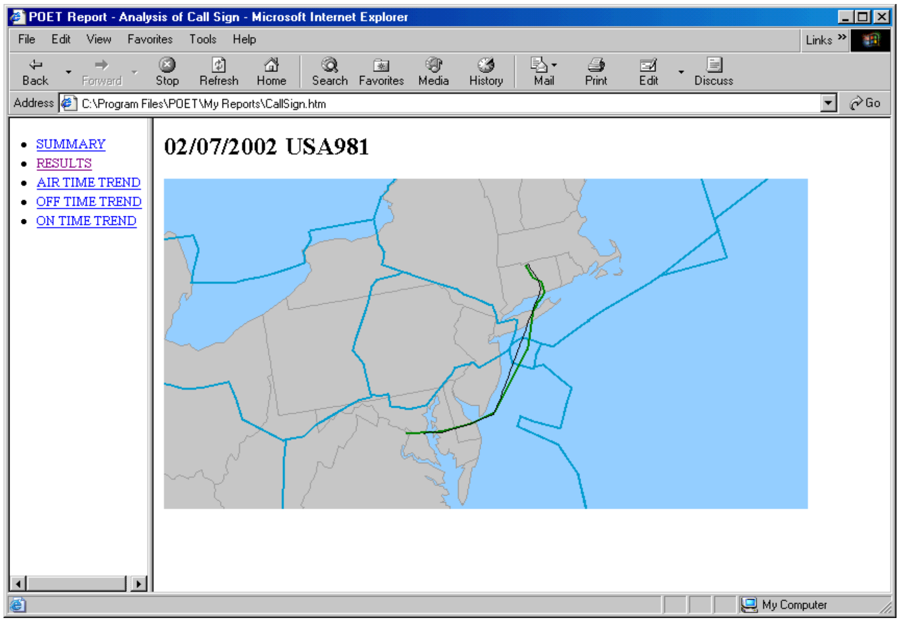

Exhibit 5-38. POET Mapped Results

Likewise, if the specialist wishes to view a chart summarizing the activity for a single arrival fix, he selects the arrival fix name in the report.

There are several Summary Report types available including Call sign Analysis, Circular Holding, Arrival Fix Compliance, and various NAS-related events.

Specialists can conduct both flight-based and airspace-based searches. A flight-based search is useful for finding information about different flight groups into or out of specific airports.

Advanced Charts, each of which uses a unique algorithm, are also available via POET. The Advanced Chart options described here are current as of the initial release of POET 2.0. Note that the available options may change with future versions of POET. POET also provides the option of using an external module plug-in to generate a chart.

The Sector Volume algorithm determines the maximum number of flights in a sector during each time bin for the specified time period. Results are plotted as a line chart as shown in Exhibit 5-39. POET Sector Volume Chart. This is a useful tool for sector workload analysis and the near real time version of POET may eventually be used for this in the operations environment.

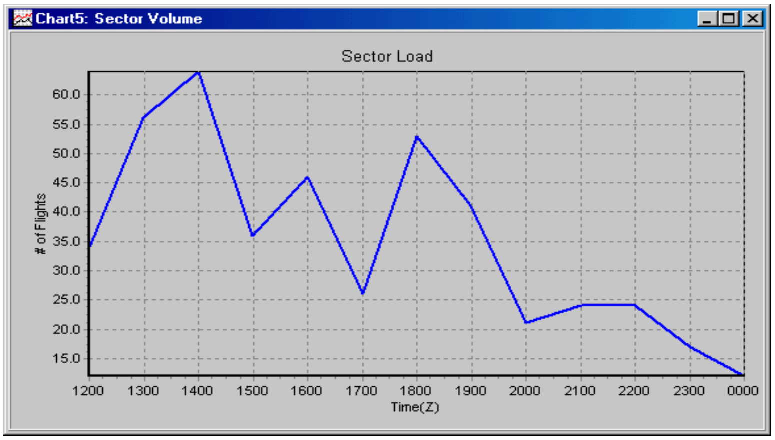

Exhibit 5-39. POET Sector Volume Chart

There are several Airport Arrivals and Departures algorithms available. The algorithms each use different arrival and departure data to generate a chart based on Actual, Filed, or Scheduled data. The algorithms create either a bar or line chart showing the number of departures and arrivals at an airport that actually occurred (based on ETMS data) during each time bin for the specified date and time period.

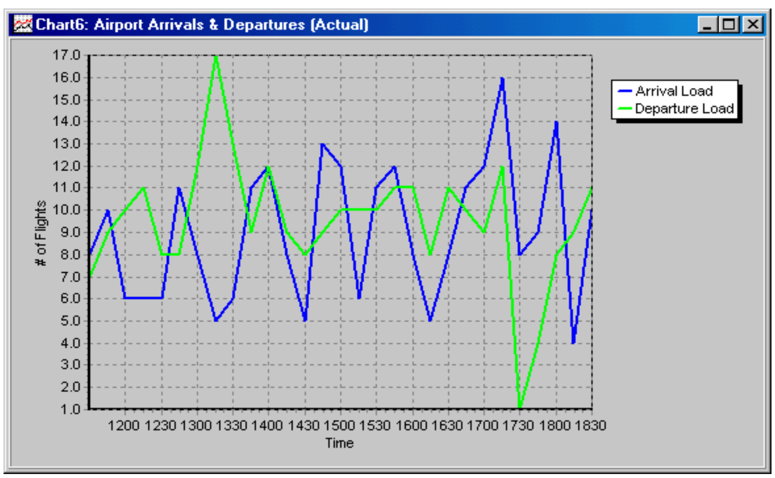

Exhibit 5-40. POET Airport Arrivals and Departures Line Chart

- The Top 10 Arrival Airports with Circular Holding algorithm creates a bar chart showing the top 10 arrival airports with flights that experienced circular holding.
- The Top 10 Airports with Arrival Fix Changes algorithm creates a bar chart showing the top 10 airports with the most arrival fix changes (planned vs. actual) for flights that arrived between the selected start date and start time and end date and end time.

- The Center Volume algorithm determines the total number of flights in a center or multiple centers during each time bin for the specified time period, and then plots the results as a line chart.

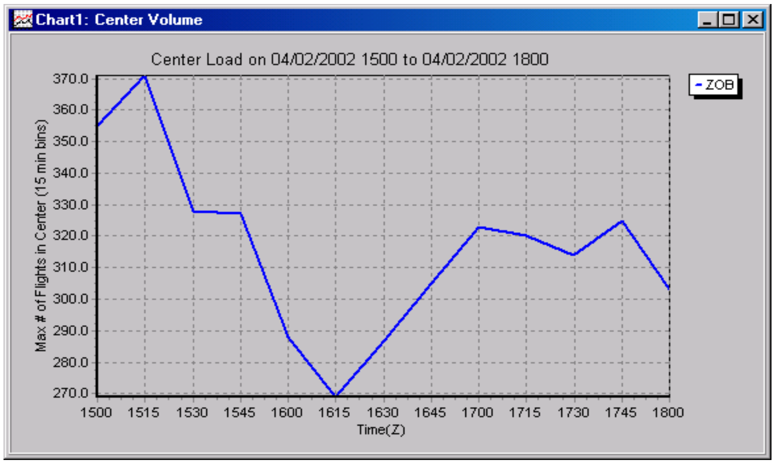

Exhibit 5-41. POET Center Volume Analysis Chart

5.3.4.4.4 Traffic Situation Display (TSD)

In either near real-time or after an event, specialists and analysts may use the TSD to perform historical or predictive functions with traffic situation data. For example, a specialist might examine a history of flights by using the *History* feature, which causes the TSD to show the previous flight positions. By using the *Replay* feature, the manager can also perform historical analysis. Replay causes the TSD to show traffic situation data with Monitor Alert and weather data for a past time interval. During replay, the TSD looks and acts as if it is displaying live data except that the display can be started, stopped, and speeded up. The data can be replayed forward or backward in time. ETMS saves the most recent six hours of data on line for replay purposes. Data from earlier than that would have to be reloaded to enable this function to work.

List reports (textual reports of flights arriving at, departing from, or traversing an airport, fix, sector, or ARTCC) may be generated and examined in conjunction with other data to provide a complete picture of an event. Some reports provide data records for each individual flight, while others show only the number of flights in each time interval. A traffic manager requests reports through the TSD or the TM Shell. Report data is available for times up to 12 hours in the past for any location, and up to 28 days in the future for airports and ARTCCs, or up to 15 hours in the future for sectors and fixes.

ETMS allows the traffic manager to request six types of reports for analyses:

- Flight list (LIST) - The manager can request a list of flights and associated information and can specify the time interval, the flight data to appear in the report (e.g., flight ID, scheduled arrival time, aircraft type) and the order in which the flights should appear (e.g., sorted by airline, proposed departure time).

- Flight counts (COUNT) - The manager can request a count of the number of flights departing from, arriving at, or traversing an airport, fix, sector, or ARTCC and can specify the time interval for the counts (e.g., number of arrivals per hour, per 15 minutes) and the categories for counting (flights by aircraft type, by airline).
- Arrival delay prediction (ARRD) - The manager uses this report to assess potential traffic congestion by predicting arrival delays.
- Fix loading (FIXL) - The manager can request a count of the number of flights traversing a specified arrival fix or all arrival fixes for a specified airport.
- Verify time (VT) - The manager can request time verification for flight arrivals and departures, that is, discrepancies between the actual arrival and departure times and a specified time type (scheduled, proposed, original, or controlled). The manager can specify the flights, time type, and the report format.
- List flight plan (LIFP) - The manager can request lists of flight plans for selected aircraft.

5.3.4.4.5 Facility Logs

Facility Logs, including ETMS Log, TMLog, and local log tools, record operational data throughout the day and are used to produce the Facility Record of Operations. The Facility Records are used in daily operational review meetings to examine previous day's events. Log data can be extracted and analyzed externally. TMLog parses user entered and default data in a standardized format to produce a variety of reports for later manual analysis.

5.3.4.4.6 Departure Spacing Program (DSP)

DSP's relational database maintains a complete list of departure schedules, flight information, and DSP airport information for the entire ARTCC. DSP also maintains airport, aircraft, and fix adaptation data that are used by DSP system components. DSP's database management system provides fix flow rate restriction, airport, and flight data for display at the TRACON and the ARTCC. DSP data are archived on tape for further analysis.

5.3.4.4.7 Performance Data Analysis & Reporting System (PDARS)

PDARS is installed at SCT to provide a variety of post-event analysis tasks, including the production of track diagrams based on radar data (which can be sliced a number of ways). PDARS has been used to illustrate how TM instructions are interpreted by controllers and flown by pilots. PDARS is under beta test at this time.

5.3.4.4.8 Future ATM Concepts Evaluation Tool (FACET)

FACET as well as System Wide Evaluation and Planning Tool (SWEPT) are in beta testing in the AOCs. FACET's current functionality enables airline specialists to perform TFM strategy analysis to get a deeper understanding of current day operations. It will also be used in the development of new operational concepts and for analysis and benefit studies of controller decision support tools. At the present time, FACET uses 'canned' ETMS data. Eventually FACET is expected to receive live ETMS data, and to include CCFP information. There is some possibility of a future connection with DSP to provide a 'beyond the departure fix' view to allow better integration of departures in congested areas into the enroute streams/routes, using DSP.

5.3.4.4.9 Detailed Policy Assessment Tool (DPAT)

DPAT is used at the ATCSCC by MITRE staff for fast time simulation to model current and future air traffic scenarios, providing a means for predicting the impacts of traffic flow management initiatives under varying traffic and weather conditions.

DPAT scenarios can be run a number of times with a series of reroute sets, MIT sets, differing resource capacities and schedule changes to see what might have been done better, and to plan for future tactics under similar circumstances. The baseline scenario is run first followed by the defined variable scenarios to be compared to the baseline.

Several scenarios can also be run simultaneously to provide easily viewable comparisons. DPAT allows injection of weather to the scenarios, has a set of aircraft flight characteristics, and contains a database management system for managing/storing results.

5.3.4.5 Analysis at Local Facilities

The following information is derived primarily from a visit to ZAU by the Audit Team. At other facilities visited, most trend analyses were performed by the Airspace and Procedures personnel who were not interviewed.

Within the TMU, due to the more tactical (short term strategic) environment, TMCs had little time to conduct much analysis in real time. Most were observed to rely on experience and local knowledge as well as input from the Supervisor who did most of the necessary research. The Supervisor watched for FSM alerts, monitored weather trends/CCFP/RVR, participated in the SPOs, and ran any required program modeling using FSM.

The ZAU Traffic Analyst's tasks include preparing a summary of each day's activities to be used for briefings. These are stored in the database and automated as much as possible.

The traffic analyst spends considerable time looking for trends such as things that are not working well under current LOAs and for impacts such as delays resulting from restrictions imposed by another facility.

The ZAU Traffic Analyst does not have a TSD available. For security reasons, ETMS data is not available for analysis except via printouts. Consequently, ZAU developed a series of log programs (see Section 6.3, Local TFM Tools) that have become the primary source of post analysis data. These logs are placed on the administrative LAN daily and are easily downloaded to the Traffic Analyst's computer.

OPSNET data also is used as data input for analysis tasks. Daily OPSNET reports are no longer available in the text form which used to be scanned and formatted using a locally developed program. OPSNET data now is only available in Adobe format, so any data used from these reports has to be manually transcribed into the Excel database used for traffic analysis. This process is time consuming, error prone and cumbersome. The type of data used from OPSNET includes start time, end time and duration for delays.

CRU-X data is also regarded at ZAU as another useful source of holding data and is available on the administrative LAN.

For traffic analysis purposes, ZAU uses a Visual Basic interface with a series of templates and an Excel database. The database is automatically populated from the series of locally developed logs.

The Traffic Analyst produces the following reports:

- Red Alert Sector Summary report for the TMO
- A series of standardized daily and monthly reports, such as Non-Compliance reports, and a Delay Summary which includes, by departures and arrivals, the cause and quadrant. The latter report is generally run to allow delays imposed by other facilities to be reviewed for the resulting impacts at ZAU.
- A Summary Sheet of TM Initiatives is also produced, showing the peaks and delays. These are used to determine what facility to 'charge' delays to.
- SWAP Days report (which includes on a YES or nothing for each day)
- Runway Utilization report (delays leading to AAR changes)
- Red Alerts (sorted by sector / date)
- 'Flew but did not File' reports: Lists flights which filed after a program, and which actually flew but were not scheduled to fly through OAG (i.e. a charter, ferry flight or additional flight) and which may not, as a result, receive an FA delay.

Using charts, the Traffic Analyst can also derive peak hours which sectors alert most frequently, which helps managers to determine fix-loading problems and what to do about them.

POET is only occasionally used at ZAU due to its 'slowness'. Often overnight searches are required. Templates for searches may accelerate this. Searches yield a listing of aircraft but cannot be expanded to data about a single flight, leading to the need to conduct double searches.

5.3.4.6 Data Quality Analysis at Volpe

Volpe tracks CDM airline data captured for flights arriving and / or departing from pacing airports, analyzes it against several agreed upon indices (established by the CDM Group), and posts reports on the Volpe CDM DataGate website. Airlines have access to summary (averages and trends) data for all CDM airlines, and detailed data only for its own flights and those of its sub-carriers. The purpose of this endeavor at the present time is to establish benchmarks for each of the primary metrics.

The primary metrics being tracked and analyzed by Volpe QA includes:

- Timeout-cancelled flights as a percentage of:
  - All flights planned to operate (FS, FC, or FM messages)
  - All cancelled flights (for any reason).
- Airline-cancelled (FX message) flights that operate as a percentage of:
  - All flights planned to operate (FS, FC, or FM)
  - Airline-cancelled flights (FX message but not FX followed by FC message).
- Unscheduled Flights (no FS) that operate without a CDM Message (no FC, no FM message) as a percentage of:
  - All flights that operate
  - Unscheduled flights that operate.

Other metrics that are being tracked by Volpe include:

Scheduled (FS) Flights that operate without a CDM Message (i.e. no FC nor FM message) as a percentage of scheduled flights that operate. This metric measures the quality of the daily schedule download.

Flights that depart at least 15, 30, 45, or 60 minutes after their EDT where the EDT was in ETMS at least 10 minutes prior to the Actual Departure Time (ADT) as a percentage of all flights that operate, and as a percentage of all delayed flights (with actual departure times after OAG time)

Controlled flights that depart at least 15, 30, 45, or 60 minutes after their EDT where the EDT was in ETMS at least 10 minutes prior to the Actual Departure Time (ADT) as a percentage of controlled flights that operate

These metrics are displayed on the Volpe CDM DataGate website using comparative bar charts and trend charts.

The comparative bar chart shows the value of the metric for the specified interval by airline. As well, the bar chart can be used to display the average value of the selected metric for the specified interval, averaged across all airlines. Eventually this ‘average value’ will be replaced by the benchmark value once it has been determined. Users can specify a begin and end date for the chart display.

The trend chart capability allows users to specify an airline and display the weekly value of a metric over the last 4 months. In addition, users can specify a begin and end date and request a list of flights that meet the metric’s criteria during the specified interval. Users can request the display of message history for any individual flight.

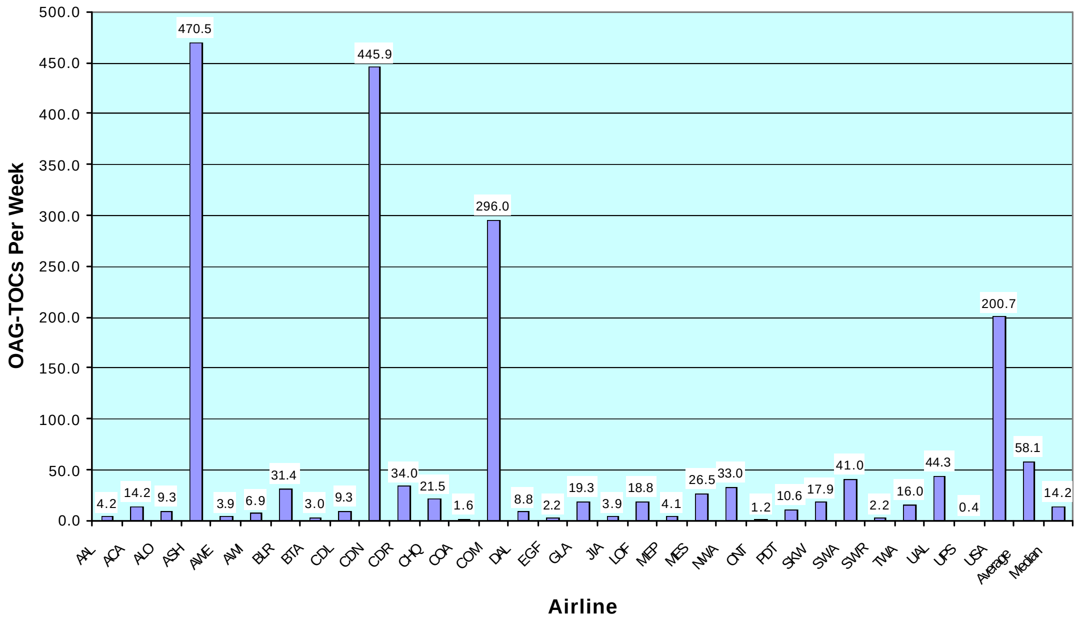

Exhibit 5-42. Average OAG-TOC per week by Airline

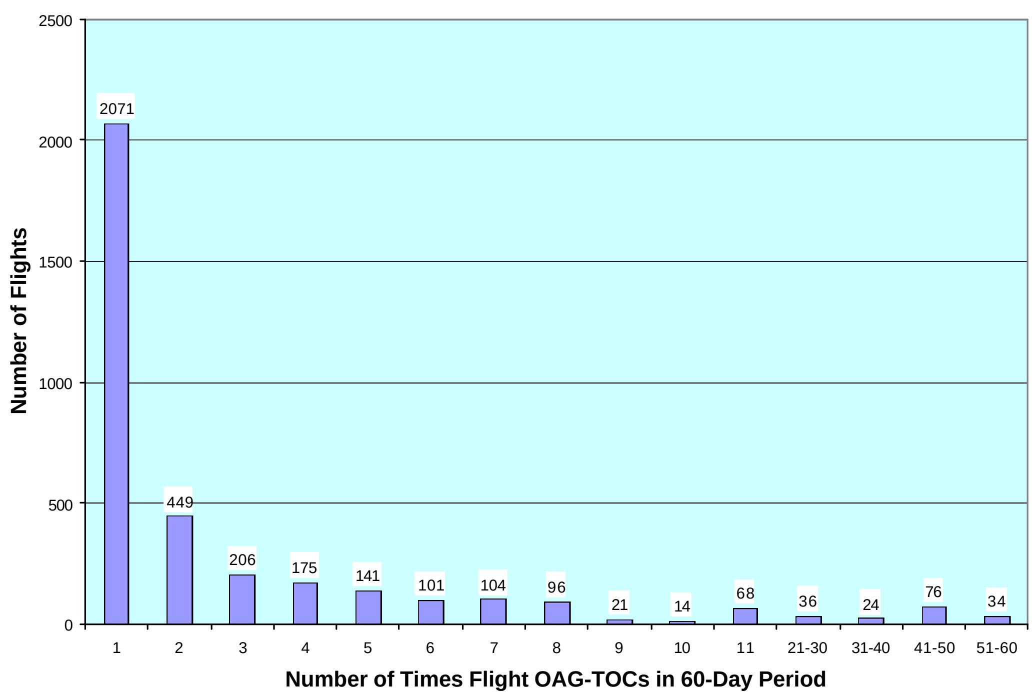

Exhibit 5-43. Frequency Distribution of OAG-TOC Flights

Two other products are also available on the Volpe website to help airlines find their own data problems:

- OAG Time-outs: highlights OAG schedule errors.
- GDP Time-outs: daily report of any flight in a GDP that time-out cancelled.

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